



Exploring the Trade Impacts of Fossil Fuel Subsidies

GSI REPORT



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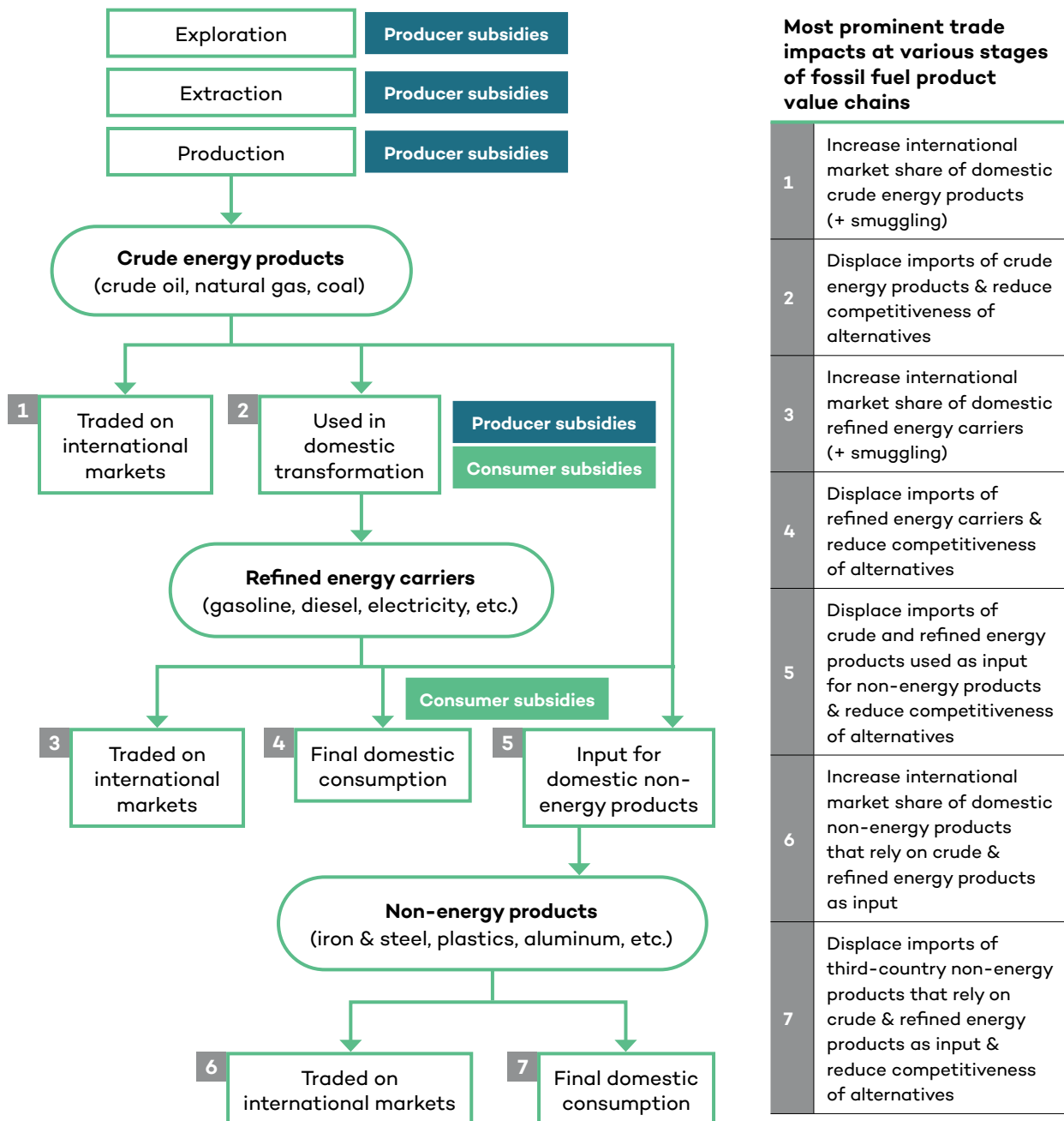
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Executive Summary

Existing research on the trade impacts of fossil fuel subsidies is sparse. This paper, however, emphasizes that there are various pathways through which fossil fuel subsidies can affect the competitiveness of industries at different stages of fossil fuel product value chains (Figure ES1) and lead to significant trade impacts.

Figure ES1. Trade impacts of fossil fuel subsidies at various stages of fossil fuel product value chains

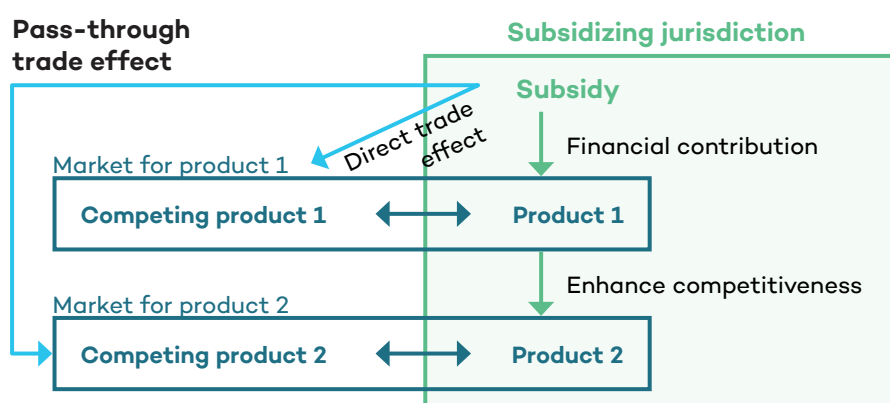


Source: Authors' diagram.



Such impacts can materialize through both direct and pass-through effects (Figure ES2). Direct trade effects occur when subsidies provided to fossil fuel producers affect the markets for energy commodities such as crude oil, natural gas or coal, as well as transformed energy products, through reducing producers' costs of extraction or transformation, respectively. They also manifest when fossil fuel consumption subsidies directly decrease the costs of fossil fuel inputs used by various industries, whether they process feedstocks into value-added energy types (e.g., gasoline, diesel, electricity) or they use energy products as inputs to produce non-energy products (e.g., iron & steel, plastics). Pass-through trade effects occur when fossil fuel subsidies provided to upstream fossil fuel producers lead to lower-cost energy products that can then be used as input in other production processes downstream. Part of the subsidy benefit is "passed through" to downstream producers. For example, a steel producer may not enjoy a direct subsidy, but it can still benefit from upstream coal subsidies that lower the price of coal, which is a key input into steel production.

Figure ES2. Direct and pass-through effects of fossil fuel subsidies



Source: Authors' diagram.

There are also impacts across different markets when a country that subsidizes a certain product uses less of a non-like substitute product. For example, a country subsidizing coal that benefits coal-fired power plants will very likely use less renewable energy technologies than in a scenario in which there were no coal subsidies. Not only do fossil fuel subsidies thus affect trade in fossil fuels and energy-intensive products, but they also pose a problem for the development of cleaner alternative technologies.

Looking at empirical evidence to shed light on the potential scale of fossil fuel subsidies' trade impacts, we find that markets for fossil fuels, refined energy products and non-energy, energy-intensive products are enormous. Trade in crude oil, petroleum products, natural gas and coal was at least valued at USD 943 billion, USD 800 billion, USD 299 billion and USD 124 billion in 2018, respectively. Many energy-intensive industries are also major exporters. We find a minimum value of energy-intensive products trade of USD 1 trillion and of electricity-intensive product trade of USD 300 billion. Most of these industries also have a high competition density, meaning that trade is dispersed and highly competitive. In comparison, the total value of *all* product exports worldwide in 2018 was USD 19 trillion. This means that fossil fuel products trade alone, excluding energy-intensive industries, represented more than 10% of all worldwide trade value.



Both these markets' trade volume and export value, as well as their competition density, highlight that fossil fuel subsidies can have significant impacts on who wins and who loses in terms of domestic and international market share of crude products (i.e., primary fossil fuel products that are minimally processed) as well as value-added energy types or energy-intensive goods (Figure ES2). Fossil fuel subsidies can do so by affecting the marginal cost of production of final goods or inputs to other industries. Fossil fuel subsidies also often lead to smuggling and can reduce the competitiveness of more sustainable alternatives, which raises particular concerns in light of the need to transition to greener energy systems.

Table ES1. Affected markets and trade exposure

Affected market	Annual trade volume (% of global prod.)	Annual trade value (USD, 2018)	Competitive density	Key trade impact
Upstream oil	~ 50%	943 billion	High	Battle for market share
Upstream gas	~ 25%	299 billion	High	Battle for market share
Upstream coal	~ 16%	124 billion	Medium	Battle for market share
Electricity	Very small	35 billion	Small	Obstruction of trade
Petroleum products	~ 15%	779 billion	Very high	Battle for market share; smuggling of refined fuels
Energy-intensive industry	Industry-dependent	> 1 trillion	Very high for key industries	Battle for market share
Electricity-intensive industry	Industry-dependent	> 300 billion	Very high for key industries	Battle for market share

Notes: (1) Estimates of trade value represent minimum values since they are based on a conservative accumulation of HS6 product identification codes; (2) Competitive density is about the concentration of both importing and exporting countries, with a high density (corresponding to a low concentration rate) indicating more dispersed trade; (3) Battle for market share is about the battle within dedicated fossil fuel markets, but also against potential alternatives such as renewable energy (for example by crowding out investment).

Our analysis thus highlights the relevance of fossil fuel subsidies from an international trade policy perspective, in particular for the World Trade Organization (WTO). Despite the significant trade impacts fossil fuel subsidies can have, the WTO's current subsidy disciplines have been unable to really constrain the widespread use of such support measures. Against this backdrop, a series of options have been discussed for the WTO to engage more with fossil fuel subsidies. Five main options have been proposed: (1) improving transparency; (2) building capacity to identify, understand and reform subsidies; (3) establishing a pledge-and-review process; (4) clarifying how existing rules should apply; and (5) negotiating new subsidy disciplines. While pursuing any of them will undoubtedly require strong political will, most do not require multilateral consensus for interested WTO members to start engaging. They are also not mutually exclusive and could be advanced in combination.



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1.0 Introduction

In recent years, there has been growing attention to fossil fuel subsidies and the need to reform them. Originally, subsidies on the production side aimed at improving energy security and subsidies on the consumption side were intended to protect the welfare of households. Such subsidies, however, have also contributed to fiscal deficits for governments, led to increases in carbon emissions and air pollution, and generally slowed down the energy transition (Merrill et al., 2017b). Subsidies are also used as an industrial policy tool, which can yield positive benefits to certain industries. While some of these support measures reduce the marginal cost of production of crude fossil fuel products, others are targeted at downstream transformation or use (into and of value-added energy products). Despite the obvious trade implications that fossil fuel subsidies thus can have, those trade impacts have not yet been discussed in detail.

“Rationalizing inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions” was included as a target of the Sustainable Development Goals under SDG target 12.C. This was primarily motivated by the impacts of fossil fuel subsidies on carbon emissions and air pollution. Most recent models have estimated that fossil fuel subsidy reform could lead to emissions reductions of around 6% to 10%. Even though sustainable development is a central consideration in the preamble of the WTO Agreement, progress on fossil fuel subsidy reform has been very slow within the organization. Lack of understanding about the to-date under-researched implications of fossil fuel subsidies from a trade perspective is certainly one of the main factors contributing to this situation. The year 2017, however, was important for the linkages between fossil fuel subsidies and trade, concluding with the presentation of a ministerial statement on fossil fuel subsidies at the WTO’s Eleventh Ministerial Conference in Buenos Aires, endorsed by 12 members. The joint statement asked to “advance discussion in the World Trade Organization aimed at achieving ambitious and effective disciplines on inefficient fossil fuel subsidies that encourage wasteful consumption” (WTO, 2017, p. 1). This paper seeks to inform that discussion.

The key focus of this paper is on the trade impacts of fossil fuel subsidies. It starts by setting out the current state of the literature on the topic in Section 2, before presenting a conceptualization and explanation of the various pathways through which fossil fuel subsidies can affect trade in Section 3. Section 4 then looks at empirical evidence to shed light on the potential scale of those trade impacts. Finally, Section 5 presents a series of options for how the WTO could engage more with fossil fuel subsidies and contribute to advancing their reform.



2.0 Literature Review

The trade impacts of fossil fuel subsidies have not yet been thoroughly analyzed. Studies have often indicated the impact that subsidies and subsidy reform can have on the domestic economy and domestic sectors. The trade exposure of these sectors is, however, rarely discussed. This is not because those trade impacts are absent, but rather because they have not served the primary purpose of existing analyses. This section describes the key studies discussing the sectoral impacts of fuel subsidies and their reform, as well as the few trade impacts that have been highlighted in the literature. The next sections then provide a broader overview of the different types of trade impacts fossil fuel subsidies can have and highlight the trading volumes of various fossil fuel and energy-intensive products, showing that such impacts are likely significant.

Finding 1: Fuel consumption subsidies can have large direct trade impacts.

Energy products are internationally traded. That means that consumption subsidies in net importers have a positive impact on the terms of trade of exporting countries by increasing global demand for fossil fuel products (Ellis 2010). Subsidy reform would thus lower that demand. Overall, reducing fossil fuel consumption subsidies globally would lead to a small increase in overall global trade volumes (0.1%) but a significant shift in trading volumes of particular products and sectors (Burniaux et al., 2011). The value of that trade is, of course, linked to price, which depends on both supply and demand, and is therefore also intrinsically linked to price elasticities.

Energy consumer subsidy removal in energy-producing countries would theoretically lead to a reduction in domestic demand for energy products and a corresponding increase in exports of energy products (Manzoor et al., 2012). This effect would be especially present in developing and transition economies (Saunders & Schneider, 2000) and is similar to the effect of other cost-increasing interventions such as the introduction of value-added tax (Roos & Adams, 2019). A domestic demand reduction together with an increase in exports would be found for crude oil, natural gas and coal (Yusoff & Bekhet, 2016), but also for petroleum products. One specific study used computable general equilibrium (CGE) modelling to estimate the impacts of the elimination of energy subsidies in Iran and found that it would lead to an expansion of exports by up to 76%, mostly as a result of an increase in the exports of crude oil and petroleum products (Jensen & Tarr, 2003). This shows the significant impact that consumption subsidies can have on trade.

There are also notable effects in the electricity sector.¹ It has been observed that in the case of electricity subsidies in the Persian Gulf, market distortions because of administered pricing policies and a lack of visibility of real costs are the main obstacles to inter-state electricity trade among neighbouring countries (King Abdullah Petroleum Studies and Research Center [KAPSARC], 2016). Another study using CGE modelling in Malaysia showed that the reform

¹ Electricity consumption subsidies are considered fossil fuel subsidies for the share of electricity production that relies on the use of fossil fuels.



of electricity consumption subsidies would lead to more investment into renewable energy resources (Yusoff & Bekhet, 2016). This could open up trade in renewable energy equipment.

Finding 2: Countries use producer subsidies to improve the competitiveness of domestic industries on the international market.

Contrary to energy consumption subsidies in resource-rich countries, energy production subsidy removal would lead to a loss of domestic and international market share in terms of volume (but not necessarily of market value). For example, the Western European coal producers relied for decades on subsidies, and large parts of this industry would have shut down if those subsidies had been removed. Earlier reforms would have led to increases in coal imports from other parts of the world, notably Eastern Europe and Australia. It has also been held that subsidy removal would increase competition in national electric power industries (Steenblik & Coroyannakis, 1995; Radetzki, 1995; Anderson & McKibbin, 1997). More recently, after the financial crisis of 2008, various countries introduced new subsidies to improve the profitability of their upstream fossil fuel producers (Lin, 2014).

Finding 3: Pass-through effects are manifold and significant, and the trade exposure of many fuel-consuming sectors seems to indicate real trade impacts.

The literature provides ample evidence of the pass-through effects of fossil fuel subsidies, which occur when subsidies upstream benefit downstream producers of value-added energy and non-energy products (see Section 3). Pass-through effects appear to be the largest for energy sectors such as the refining business, even though non-energy sectors, especially when they are energy-intensive industries, can also be affected (Cockburn et al., 2018). The trade effects of some fossil fuel subsidies that benefit midstream and downstream sectors have not been widely examined, but many of these sectors are trade-exposed. Some energy-intensive sectors such as iron and steel are also heavily traded (see Section 4). Other sectors, such as cement, are less trade-exposed. Fuel subsidy reform, however, could have a very significant impact on the production costs of especially energy-intensive industries (KAPSARC, 2016). In particular, it can improve the competitiveness of alternative non-like materials if available on the domestic market. Similarly, fuel subsidies play an important role in mining. One analysis (Cosbey et al., 2016) showed that 13.7% of total mining costs of two mining companies was diesel. In case domestic mining companies receive subsidized diesel, they will gain competitive leverage over foreign competitors. In the case that mining companies are specifically targeted to receive subsidized diesel, this specific subsidization can also create direct trade impacts.

**Table 1. Literature on the impacts of fossil fuel subsidies with possible trade implications**

Study	Method	Main finding
APICORP, 2016	Case study	Subsidy reform in the Persian Gulf hikes input costs for energy-intensive industries and leads to higher production cost.
Abouleinein et al., 2009	CGE	The natural gas subsidy in Egypt lowers the price of electricity production. A 10% increase in the natural gas price would lead to a 6.9% electricity price increase.
APICORP, 2016	Case study	Subsidy reform in the Persian Gulf hikes input costs for energy-intensive industries and leads to higher production costs.
Burniaux et al., 2011	CGE	Reduction of fossil fuel consumption subsidies globally would lead to a small increase in global trade volumes (0.1%) but a significant shift in trading patterns of particular products and sectors. In particular, this would lead to a reallocation of trade flows in products of energy-intensive industries.
Clements et al., 2003	CGE	Input-output linkages would cause an increase in production costs of various sectors in Indonesia as a result of fuel subsidy reform. The utilities sector would be especially hard hit by a reduction of fuel subsidies.
Cockburn et al., 2018	CGE	The productivity of energy-intensive industries and refineries in Egypt and Jordan and Egypt decreases as a result of energy sector reform. This pass-through effect also happens due to the increase in electricity prices, affecting electricity-intensive industries such as manufacturing.
El Massnaoui & Verme, 2015	Input-output	Diesel price increases have more large indirect effects on trade than gasoline price increases in Morocco, mainly because it is widely used for commercial transport.
Ellis, 2010	CGE	Natural gas pricing reforms would reduce the competitiveness of internationally traded petrochemicals.
Jensen & Tarr, 2003	CGE	Subsidy reform in Iran can reduce the output of energy-intensive sectors such as steel, chemicals and aluminum by between 25% and 65%.
KAPSARC, 2016	Case study	Domestic energy-intensive industries in the Persian Gulf have relied on subsidies in the form of low gas prices to remain competitive in the global market. Recent reforms have meant that petrochemical, phosphate and aluminum plants have experienced increases in their production costs. The agricultural sector was also affected via diesel price reforms.



Study	Method	Main finding
Manzoor et al., 2012	CGE	Energy subsidy removal in Iran has led to a reduction of non-energy exports (including goods produced by energy-intensive industries) due to input-price increases for domestic producers.
OECD, 2019a	Case study	Energy (electricity) subsidies are important government distortions improving the competitiveness of aluminum industries, particularly in China.

Finding 4: The impact of fuel subsidy removal on GDP is acknowledged, but little is known about how changes in productivity affect terms of trade.

There is wide agreement that fossil fuel subsidy reform would improve global GDP through an adjustment of demand, a reduction of fiscal expenditure on subsidies and a general improvement of allocation of resources (Yusoff & Bekhet, 2016; Ellis, 2010). Some studies have indicated that changes in GDP resulting from such reform can have a significant impact on trade. For example, in the case of Ghana, models assessing the impact of the removal of subsidies on refined oil imports have shown that a short-term reduction of real GDP in Ghana would have positive spillovers on regional neighbours and improve their economic growth and output (Wesseh & Lin, 2016). This indicates that a change in the structure of economic output affects the terms of trade in different sectors.

Overall, however, it remains difficult to assess terms of trade for two reasons. On the one hand, there is insufficient information on input-output linkages that connect subsidies to certain sectors and those sectors to other sectors that use their products as intermediate inputs. This makes the assessment of impacts from fossil fuel subsidies and subsidy reform more difficult (Clements et al., 2003). On the other hand, the impacts of fuel subsidy removal change over time. Initially, there is a contraction of the economy, but as investment increases, capital accumulation allows for new domestic production, energy efficiency and productivity gains (Al Shehabi, 2013).

One should note that the trade impacts of fossil fuel subsidies and subsidy reform ultimately depend on a firm's available response measures. In theory, firms can (1) absorb a price shock, (2) substitute certain energy inputs with other, cheaper energy inputs, (3) improve resource efficiency, (4) pass costs on to their customers, or some combination thereof. If the first three are impossible, it is likely that a firm's competitiveness on the international market will be harmed by the fourth response measure, which is the one through which an increase in production costs directly leads to higher product prices (Rentschler et al., 2017). This negative trade impact would be reduced when other governments would also stop subsidizing energy inputs, showing how coordinated subsidy reform can help avoid pressure on domestic economies via unfair competition on international markets.

**Reminder: The environmental impact of fossil fuel subsidies is large, highlighting the importance of reform to both trade and the environment.**

Fossil fuel subsidies have an environmental impact by increasing demand for and supply of fossil fuels. Historically, the underpricing of fossil fuels has encouraged excess consumption (Davis, 2016), leading to an increase in air pollution and carbon emissions (UNEP, 2008; Whitley, 2013; Van de Graaf & van Asselt, 2017). Even in places with substantive investments in energy efficiency, if prices are kept low, there may be an increase in energy use as a result of a rebound effect (UNEP, 2011). This can be particularly the case when fossil fuel investment locks energy systems into a higher-carbon trajectory. Another effect, also related to trade, can emerge when domestic producer subsidies encourage the use of products that are dirtier than like products that could be imported from abroad. For example, Steenblik and Coroyannakis (1995) highlighted that coal being mined and consumed in Europe was higher in sulphur and ash than coal available from Australia, Colombia or South Africa, and also yielded much higher emissions of methane associated with coal extraction.

Estimates of potential emission savings vary according to scenario specifics. In a retrospective analysis, Stefanski (2014) found that between 1980 and 2010, 36% of carbon emissions were driven by subsidies. Another study by the IEA (2015) estimated that roughly 13% of current (2014) carbon emissions were driven by fossil fuel consumption subsidies, including the pricing policies of energy-producing countries. Subsidy reform would lead to a reduction of CO₂ and non-CO₂ greenhouse gases, including gases from coal mining and flaring (Steenblik & Coroyannakis, 1995; Burniaux & Chateau, 2014). Furthermore, low fuel prices clearly suppress investments in energy efficiency and renewable energy (Coady et al., 2017).

Future projections are of course difficult and dependent on quantitative modelling and price assumptions and evolutions (Gerasimchuk et al., 2017). In 2010, a joint report by the IEA, OPEC, OECD and World Bank (2010) in support of the G20 estimated a 6% worldwide emission reduction in a scenario in which fossil fuel consumption subsidies would be phased out by 2020. More recently, it has been estimated that fossil fuel subsidy reform could reduce global carbon emissions by around 10% (Climate Strategies, 2017; Merrill et al., 2017), although the effect remains dependent on oil prices and whether countries are exporters or importers (Jewell et al., 2018). A recent review found that fuel subsidy reform across 26 countries could lower emissions on average by 6% by 2025 (Global Subsidies Initiative, 2019). If appropriate taxation would be included, reductions could go as far as 28% globally (IMF, 2019). It is also evident that subsidies to the production of fossil fuels lead to higher extraction and use, so even fossil fuel producer subsidy reform alone could already yield substantial emission reduction benefits (Gerasimchuk et al., 2017).



3.0 Pathways of Fossil Fuel Subsidy Trade Impacts

The literature review has pointed to the existence of trade impacts from fossil fuel consumption and production subsidies across the whole value chain. Building on these insights, this section provides a conceptual overview and examination of the various pathways through which fossil fuel subsidies directly or indirectly affect international trade. While the first part of the section discusses the difference between direct effects and pass-through effects, the second part gives an overview of the value chain of fossil fuel products and uses it to discuss the various trade impacts of fossil fuel subsidies.

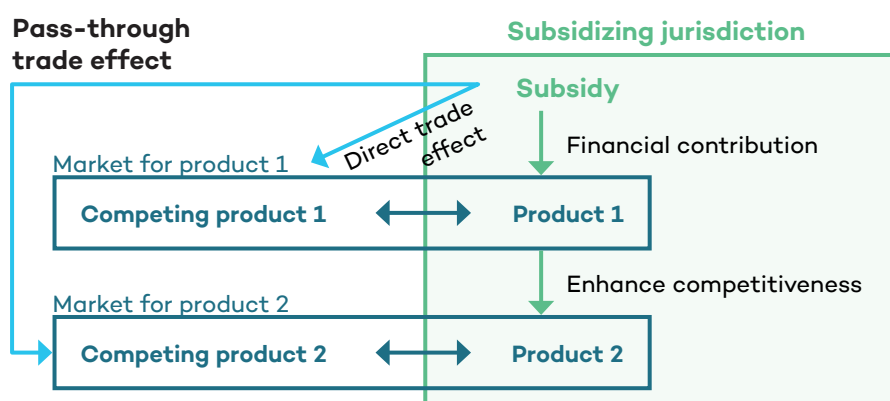
3.1 Direct and Pass-Through Effects

Articulating the trade impacts of fossil fuel subsidies may seem intricate but is not any more difficult than assessing the trade impacts of other subsidies that serve a complex value chain. The key questions surrounding the trade impacts of fossil fuel subsidies rely on the identification of markets for products that benefit directly and indirectly from various fossil fuel subsidies. It is important to note that there is no strict geographical limit to the existence of a market, as long as there is competition for the sale of a product or service that provides an appropriate foundation for considering that a market exists. Markets can thus be global, and we highlight the existence of such markets in the empirical section below (Section 4).

To understand that fossil fuel subsidies have a multiplicity of trade impacts, it is important to emphasize the complex links between subsidies and markets upfront. On the one hand, one single fossil fuel subsidy might have trade impacts in several different markets. On the other hand, one single market can be affected by several fossil fuel subsidies. Figure 1 below illustrates the difference between direct trade effects and pass-through effects. For the purpose of this paper, we define a pass-through effect as a situation in which a certain producer B enjoys a cheaper input because producer A of this input further up the value chain has benefited from a subsidy. Even though it is the upstream producer who benefits directly from the subsidy (for example to coal production), the downstream producer (for example a steel producer) can indirectly benefit from that upstream subsidy if it leads to a lower price of an input (for example coal), therefore increasing its competitiveness. By contrast, a direct effect refers to a situation where a producer's enhanced competitiveness results from a subsidy that benefits it directly.



Figure 1. Direct and pass-through effects of fossil fuel subsidies



Source: Authors' diagram.

An example of how one subsidy can affect different markets can be found in a crude oil production subsidy. This subsidy does not have an impact only on the crude oil market (i.e., a direct effect), but it can also affect the competitiveness of domestic refiners in downstream markets such as those for gasoline and diesel (i.e., a pass-through effect). Examples of non-energy products that could benefit from the pass-through effect of a fossil fuel producer subsidy could be iron and steel. This industry relies on coal, so an upstream coal production subsidy might reduce input costs for iron and steel producers. In addition to affecting downstream markets through potential pass-through effects, it is also important to note that fossil fuel subsidies can also have impacts on markets for alternative products. For example, subsidies to coal could impact the different markets of natural gas and renewable energy, wherever coal and natural gas compete (for example in electricity generation).

One single market can also be affected by various fossil fuel subsidies. One example of this can be found in the market for petrochemicals. Domestic producers of petrochemicals in some countries receive an advantage both via fossil fuel consumption subsidies that directly reduce the price of their inputs and via upstream production subsidies (as well as storage and transport subsidies) that lower the cost of producing these inputs. The latter effect is mainly found in countries where government interferes in those markets through various export restrictions or via state-owned oil and gas companies.

3.2 Subsidies and Trade Impacts Throughout Fossil Fuel Product Value Chains

Markets that are affected by fossil fuel subsidies can be found across the entire value chain. There are markets upstream in fossil fuel production, downstream in end uses of energy and energy-intensive products, and midstream in refining, transmission and distribution support (e.g., transport and storage). Upstream markets for primary fossil fuel commodities include those for crude oil, natural gas and coal. Midstream and downstream markets include those for transport fuels (gasoline, diesel and jet kerosene), grid-scale electricity generation, energy-intensive industries (petrochemicals, fertilizer, iron and steel, cement, pulp and paper, food),



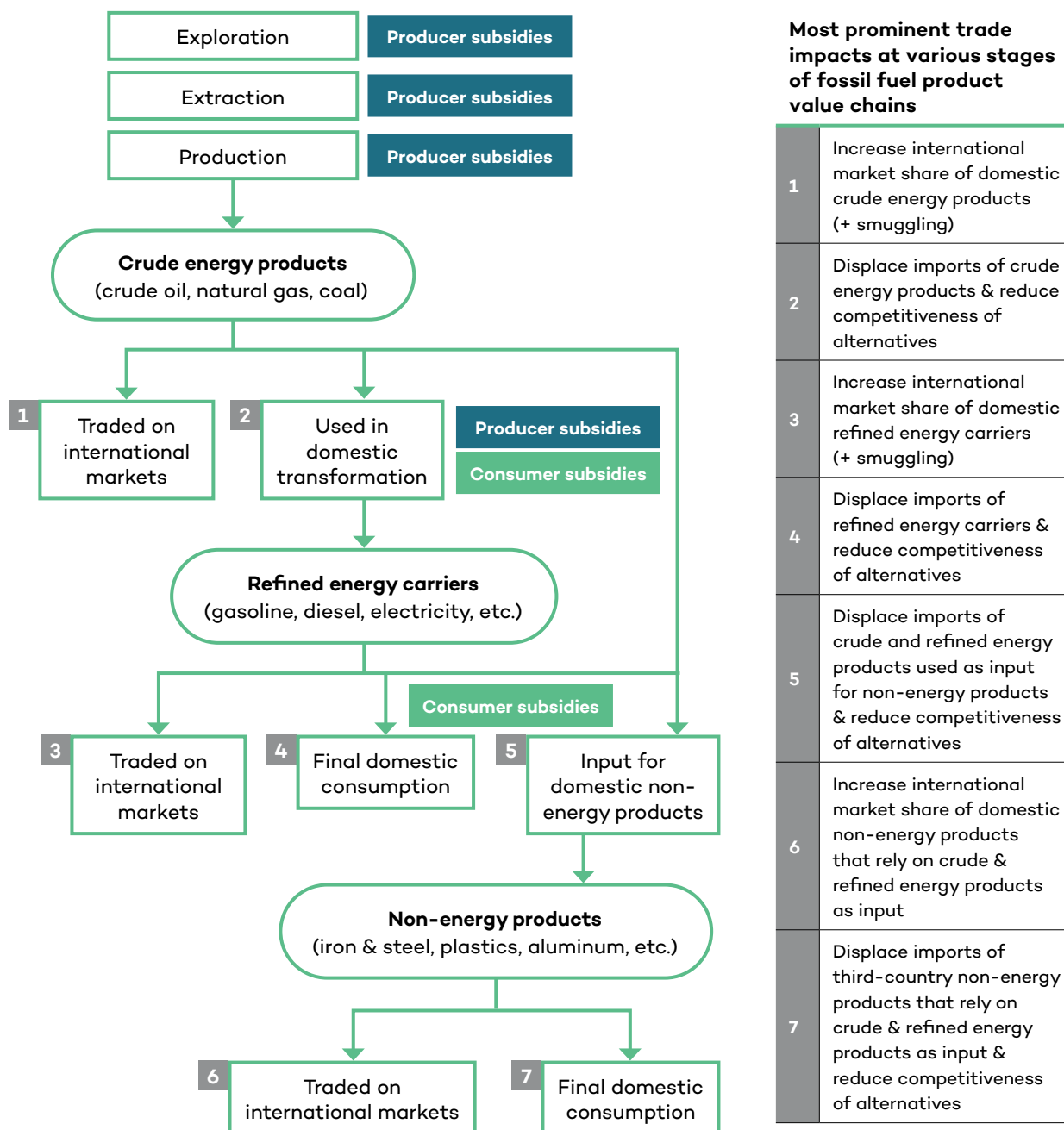
and electricity-intensive industries (aluminum, steel and other non-ferrous metals such as copper, zinc and tin). These lists are by no means exhaustive.

Figure 2 illustrates the various trade impacts that fossil fuel subsidies can have at different stages of fossil fuel and fossil fuel product value chains. The figure does not explicitly mention transport, infrastructure and R&D subsidies. Even if they mostly benefit upstream fossil fuel producers, they can still be found across the value chain (see below). In this figure, producer subsidies refer to subsidies provided to producers of fossil fuels and electricity using fossil fuels as inputs. This includes upstream producer of crude products, but also businesses that transform crudes into refined energy carriers. Consumer subsidies are support measures through which the price of a fossil fuel input is subsidized (either directly or via tax expenditure).²

² An example of producer subsidies in domestic transformation can, for example, be corporate income tax subsidies to new refineries. Such measures are not directly linked to the consumption of fossil fuels, but rather support the production of refined petroleum products. Consumer subsidies in domestic transformation, on the other hand, can take the form of price controls or tax subsidies that directly lower the price of fossil fuel inputs. One could argue that this incentivizes refining, and might thus also be considered a producer subsidy. We define consumer subsidy here as any subsidy that lowers the price of fossil fuel products. For example, in electricity transformation, we would consider that a subsidy that lowers the price of coal is a consumer subsidy at the transformation level, rather than a producer subsidy. It should be noted here that the term “production subsidy,” which is used in parts of the paper, refers only to upstream fossil fuel production of natural gas, coal and crude oil.



Figure 2. Trade impacts of fossil fuel subsidies at various stages of fossil fuel product value chains



Source: Authors' diagram.

Direct Trade Impacts of Subsidies to Production: Competition with foreign crude energy products over market share

The most direct trade impacts of fossil fuel production subsidies are in upstream markets for crude products. Empirical results presented in Section 4 also suggest that the scale of these impacts is likely very significant. Producer subsidies come in many forms of financial contributions. They can take the form of direct transfers of funds, loan guarantees, foregone



government revenue such as tax exemptions and government-provided goods or services. They can also differ in incidence by being targeted at investment, output returns, consumed inputs or value-adding factors. Often a combination of several types of subsidies will be granted to fossil fuel producers. The OECD categorizes the different types of support mechanisms in a matrix based on their transfer mechanism and statutory incidence, found in Annex 2 (OECD, 2018).

Table 2 shows the largest fossil fuel producer support measures in G20 countries, based on this OECD inventory.³

Table 2. Fossil fuel producer support in G20 countries as reported in the OECD Inventory of Support Measures for Fossil Fuels (USD million, 2017)

Fossil fuel producer support (USD million)	Coal	Natural gas	Petroleum	Total
Argentina	71	29	483	583
Australia	0	0	0	0
Brazil	49	103	185	337
Canada	0	430	680	1,110
China	673	0	220	893
France	0	119	182	301
Germany	1,733	59	319	2,112
India	67	0	0	67
Indonesia	0	180	137	317
Italy	0	46	14	60
Japan	0	456	64	520
Mexico	0	0	0	0
Russia	29	118	6,721	6,868
South Africa	0	0	0	0
South Korea	187	0	0	187
Turkey	158	0	0	158
United Kingdom	0	191	1,898	2,090
United States	389	249	-924	-285

Source: OECD, 2019a

Notes: (1) OECD producer support estimates exclude general services support estimates, which often lack sufficient clarity to link support directly to an increase in production. The OECD inventory also considers only direct budgetary transfers and tax exemptions, and has not yet included the subsidy values of government-mediated credit, such as loan guarantees; (2) The negative values for US petroleum subsidies are related to the OECD estimate for temporary expensing

³ A caveat here is that this inventory, much like other existing databases on fossil fuel support measures, suffers from countries' lack of transparency about such measures and thus may not cover all of them.



of equipment for refining. Since the inventory reports cash-based tax expenditure estimates, investment cycles can result in years of negative tax expenditures.

The most important direct trade impact is the effect that oil, gas and coal subsidies have on displacing or impeding competitors' exports of crude fossil fuel products to the market of the subsidizing economy or third-country markets (see the upper part of Figure 3). In short: subsidies contribute to a battle for market share. This impact can materialize in three ways: (1) increasing the market share of subsidized products, (2) reducing the decline of subsidized products' market share, and (3) protecting the existing market share of subsidized products, compared with a scenario without subsidies.

The likelihood of significant trade impacts appears even higher in light of the fact that fossil fuel producer subsidies seem to mostly target the key drivers of crude fossil fuel prices. In the case of oil, the most important cost component of the final price is that of extraction and production. Many oil subsidies seek to influence these processes to make domestically produced oil competitive vis-à-vis that on offer from international competitors. Most importantly, countries tend to subsidize the production of oil in situations wherein competition would otherwise be tougher, including the production of specific oil types (e.g., oil sands), in more difficult geographic and geological locations (e.g., offshore or specific subsoil properties), and in circumstances characterized by declining economic performance (e.g., depleting fields). Other subsidies target investment in—and development of—new oil resources, and can be intended to either increase energy self-sufficiency or production for export. These can include several types of tax exemptions for exploration and development costs, transport of energy commodities, accelerated depreciation, the amortization of geological and geophysical expenditure or royalty reductions. The joint impact of these measures is to support factors of production of national hydrocarbon development, with the ultimate goal of improving the competitiveness of domestic fossil fuel producers.

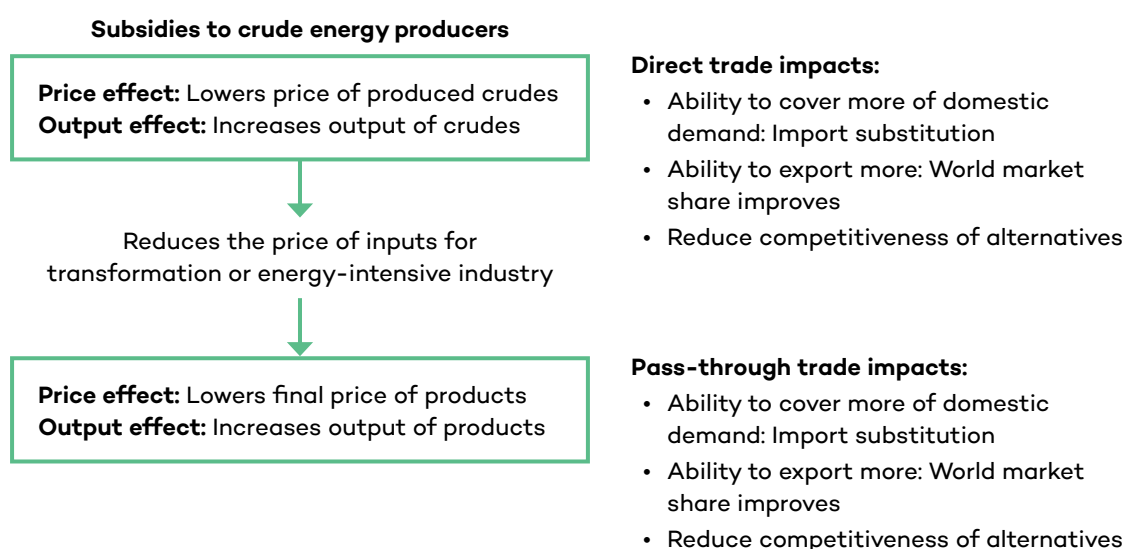
Unlike in the case of oil, one of the most important cost components of the natural gas price is the cost of its transportation. For a long time, international markets for natural gas have been regionally anchored around gas distribution infrastructure. Nonetheless, the gas market has become more complex and more globalized in recent years and continues to develop in this direction, mainly as a result of U.S. shale gas and the growing market share of liquified natural gas (LNG). Like oil production subsidies, natural gas production subsidies lower the cost of production and increase the use of natural gas. They do this in similar ways. In fact, much government support for oil production also benefits natural gas production. Other subsidies often incentivize exploration via tax exemptions and royalty reductions or target the key cost component of the natural gas price (transport) by incentivizing the construction of pipelines, LNG terminals or distribution networks.

As with the case for oil and gas, many existing coal production subsidies focus on types of coal that would otherwise be more costly. For example, the United States provides tax credits for coal mined from thin seams and areas with a high overburden ratio. Russia also provides support for extraction from already mature mines (Gençsü et al., 2019), and until the practice was ended in 2018, the EU allowed its member states to subsidize production from deep, high-cost underground coal mines. Other subsidies reduce production costs by taking on cost components that would otherwise be covered by coal companies. Some subsidies



are used to protect the safety of mining sites, while others directly benefit certain aspects of coal development such as drilling in specific geological structures. Many of these subsidies can keep domestic coal more competitive than it would otherwise be, thereby affecting trade. They can also result in crowding out investments from other alternatives, particularly from renewable energy technologies.

Figure 3. Trade impacts of subsidies to crude energy producers



Source: Authors' diagram.

Trade Impacts of Direct and Pass-Through Subsidies to Transformation and Industry: Competition for market share over refined energy products, non-energy products and impacts on renewable energy

Energy transformation and industrial activities can benefit from fossil fuel subsidies in three main ways. First, upstream production subsidies can lower the production costs of crude products and therefore the input costs of businesses that transform those products into refined energy carriers or other products (pass-through effects; see the bottom part of Figure 3). Second, consumption subsidies also decrease the costs of these inputs, but more directly (see trade impact 2 in Figure 4).⁴ Third, producers of refined energy carriers can also directly benefit from subsidies to their production.

When fossil fuel subsidies lower the production costs for producers of value-added energy products or non-energy products, then these sectors gain a competitive advantage both within the home market vis-à-vis imports and in international markets. This is particularly the case for energy-intensive products or services—including both refined energy products and the products of energy-intensive industries—but could also apply to other sectors with stiff competition in which small changes in production costs can alter the competitive position of various producers. Pass-through effects can thus trickle down the value chain. For example,

⁴ See Annex 1 for an overview of the trade impact pathways of various fuels and fuel products



certain manufacturing industries can be reliant on steel and plastics. While less is known empirically about such cases, the possibility of such pass-through effects illustrates how distortionary fossil fuel subsidies can potentially be.

Fossil fuel subsidies can also affect trade in competing products. If oil, gas and coal subsidies benefit certain products that have available foreign and unsubsidized substitutes, then the producers of those substitutes lose out on potential market uptake in the subsidizing economy and even in other markets. To give an example, if electricity producers in a country receive subsidized coal as an input, the competitiveness of renewable energy and its uptake in that country is likely to be adversely affected, even though the directly subsidized good (coal) and renewable energy equipment are not like products. This type of effect is under-researched but probably very large. In the absence of fossil fuel subsidies, renewable energy technologies would likely be far more competitive than they are today.

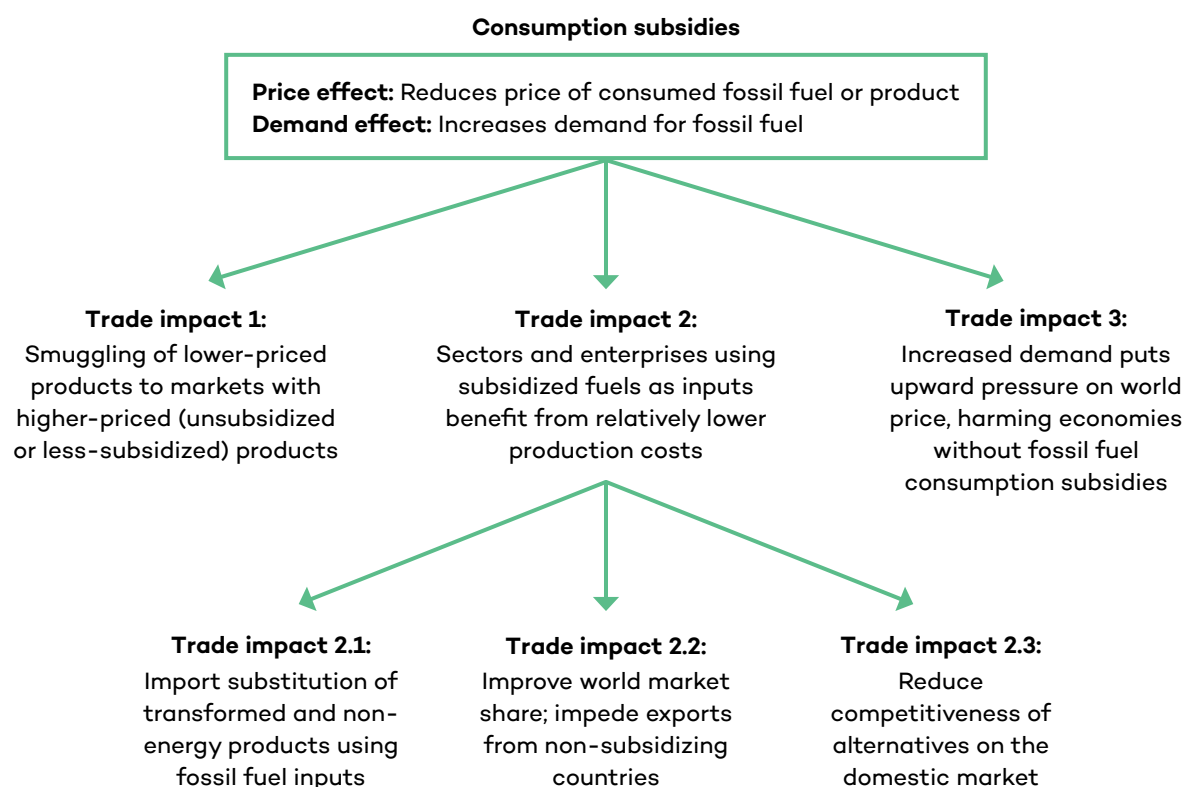
Trade Impacts of Subsidies to Final Consumption: Well-known but under-researched economy-wide impacts as well as neighbouring country trade impacts

Apart from increasing the competitiveness of domestic industries using fossil fuels as input, there are several other potential trade impacts of fossil fuel consumption subsidies (see Figure 4). On the one hand, there are global economy-wide effects. If many countries have economy-wide fossil fuel consumption subsidies, then their combined effect leads to excess demand for and consumption of energy products and energy-intensive products on a global scale. This can create adverse trade impacts for countries with liberalized energy pricing mechanisms. Such subsidies can insulate a large number of end-users from cost-reflective prices worldwide, with the subsequent excess demand leading to an appreciation of trading prices for energy products. This effect is, of course, dependent on the exact price elasticity of global demand. Consequentially, it would be users relying on fossil fuels within countries with liberalized pricing policies that would bear the pressure of higher international energy prices, negatively affecting their competitive position on domestic and international markets. Another trade effect can occur because fossil fuel subsidies result in air pollution and global climate change, which negatively affect the productivity of workers and firms. This can occur through a decline in the productivity of human capital as a result of air pollution (See, for example, He et al., 2019; Zivin & Naidell, 2011) or a decline in general productivity as a result of temporary and partial shutdowns of (parts of) production processes.

On the other hand, there are trade impacts between neighbouring countries. Consumption subsidies for easily transportable energy products (especially gasoline, diesel, kerosene and LPG) can lead to smuggling of these products to neighbouring countries with higher prices. While such smuggling benefits the neighbour's local economy, it also undercuts sales by its legitimate fuel product suppliers. For their part, electricity subsidies can discourage cross-border trade in those areas where grids would allow for that. These subsidies lower the cost of electricity to end consumers. Neighbouring electricity producers (whether fossil fuel- or renewables-based) might thus not be able to offer electricity to a subsidizing country if the tariff they would receive for this electricity is too low.



Figure 4. Potential trade impacts of consumption subsidies



Source: Authors' diagram.

Note: Some impacts (trade impact 3 in particular) ultimately depend on price elasticities

Impacts of Subsidies to Transport, Infrastructure and R&D: Large and relevant to trade

While transport, infrastructure and R&D subsidies can be found across the whole fossil fuel value chain, they appear to be especially important in upstream production processes. Subsidies are particularly important for transport infrastructure for natural gas since transport is the largest cost component of its final price. For example, the OECD Inventory of Support Measures for Fossil Fuels indicates that the largest producer support subsidy in India (almost USD 700 million annually) is for oil companies for the transport of natural gas to the northeastern region.

R&D subsidies are also often used to support firm performance, not just innovation. A distinction is often made between applied R&D, which can support firm-level productivity increases, and development R&D, which focuses more on innovation. It is difficult to track whether R&D subsidies are strategically used to support specific industries, as it would require highly disaggregated R&D subsidy data, including which firms they support and to what extent. That said, it seems that R&D fossil fuel subsidies are often used to help firms reach higher international technological and environmental standards. They can reduce a firm's costs and help it raise productivity, which would positively affect its competitive position on domestic and international markets. This support can thus be considered as indirect



support for import substitution or for improving domestic firms' export market share (Maskus, 2015; Koh & Lee, 2017). The level of trade distortion will depend on the size of subsidies and the degree to which they support firms' competitiveness in domestic and international markets. R&D subsidies for fossil energy can also affect the competitive position of renewable alternatives. For example, R&D in coal can enable the industry to maintain a price level against which renewable electricity finds it difficult to compete.

One notable example of R&D subsidies are those provided to the U.S. fossil fuel industry. In 2017, U.S. federal support for fossil energy R&D reached USD 732 million, of which USD 646 million was allocated to coal (OECD, 2019b). A large amount was intended to support coal liquefaction. Available information, however, does not make the distinction between basic and applied R&D. There are nonetheless reasons to believe that some applied R&D is involved, given the increase in fossil energy R&D in stimulus packages after the 2008–2009 financial crisis and the general decline of coal production and exports in the United States. R&D subsidies also played an important role in the rise of U.S. shale oil and gas production by supporting the development of drilling technology.



4.0 Empirical Evidence of Fossil Fuel Subsidy Trade Impacts

The literature review presented in Section 2 along with this conceptual overview of how fossil fuel subsidies affect trade together point at three broad conclusions. First, fossil fuel subsidies can have large trade impacts. Second, there are various pathways through which these impacts can materialize, and both direct and pass-through effects are important. And third, several subsidies together can affect the competitiveness of a product, while the same subsidy can also affect the markets for several different products. In this empirical section, we look at concrete numbers to further shed light on these trade impacts, in particular, to better understand their potential scale and importance.

First, we assess the trading volumes of various fossil fuels (Section 4.1, lessons 1–4). Second, we look at the monetary value of exports of fuels and fuel products. We also assess the market concentration of these products to indicate that the trade in fuel and fuel products is dispersed (Section 4.2, lessons 5–6). Third, we highlight how several fossil fuel subsidies together can affect different markets by giving two examples of some of the largest producer and consumer subsidies (Section 4.3). Finally, we use a few key indicators to compare the potential trade impacts of fossil fuel subsidies on various markets (Section 4.4).

4.1 Trade Volumes of Fossil Fuels

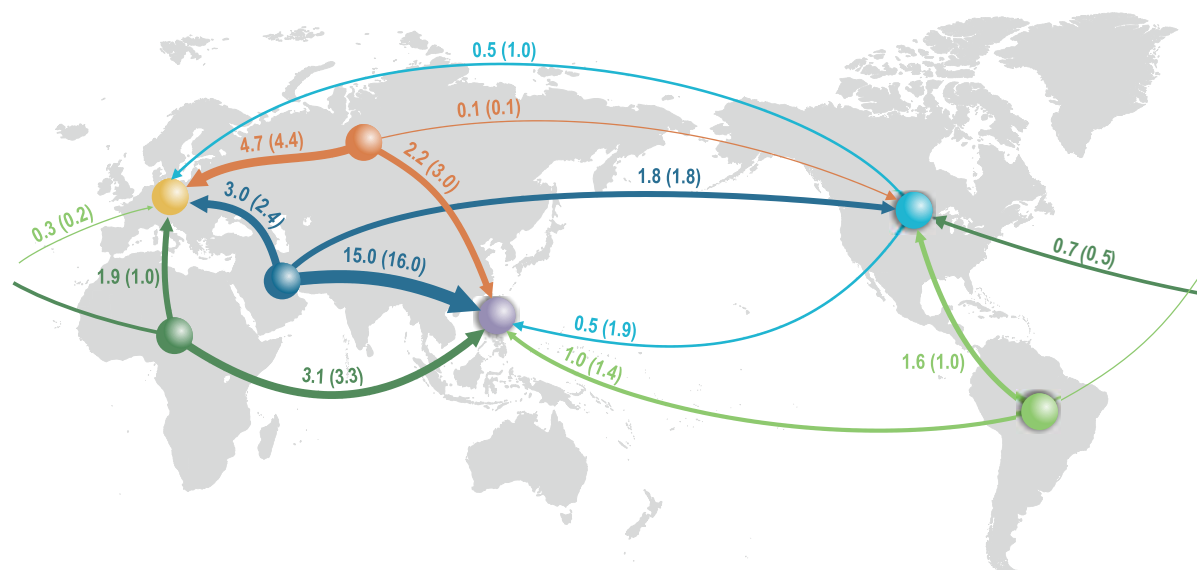
Lesson 1: Half of crude oil produced is traded before used.

About 2.1 billion tonnes of crude oil was traded in 2016, accounting for almost half of total global production (IEA, 2018a). In 2017, imports of crude oil and natural gas liquids (NGL) rose by 3.1% compared with 2016 (IEA, 2019a). The market for crude oil has changed significantly in recent years, with declining exports of crude and NGL from OPEC countries, mainly as a result of U.S. shale oil production and lower-than-expected demand growth. In 2017, exports from OPEC countries fell by 1.4% (Saudi Arabia by 6.7%) whereas the United States ramped up production by 15.6% (IEA, 2019a), resulting in a reduction of its imports.

Crude oil and NGL trade continue to grow alongside consumption, which has grown consistently since the early 1980s—short-term shocks because of financial crises aside. Crude oil trade volumes are expected to continue to grow over the next six years as most refining growth takes place in countries where domestic crude production is stagnant or declining. In total, the IEA expects additional refining capacity of almost 8 million barrels per day (mb/d) by 2023 (IEA, 2019b). U.S. exports of crude oil are also expected to increase and to reach 4.9 mb/d by 2023 (IEA, 2019b). Total crude oil trade is expected to increase from 36 mb/d in 2017 to 44.7 mb/d in 2040. It should be noted, however, that the IEA has often overstated the strength of fossil fuels and understated the growth of renewables (Denning, 2019).



Figure 5. Major crude oil trade flows between different regions in 2017 (2023), million barrels per day



Source: IEA, 2019e.

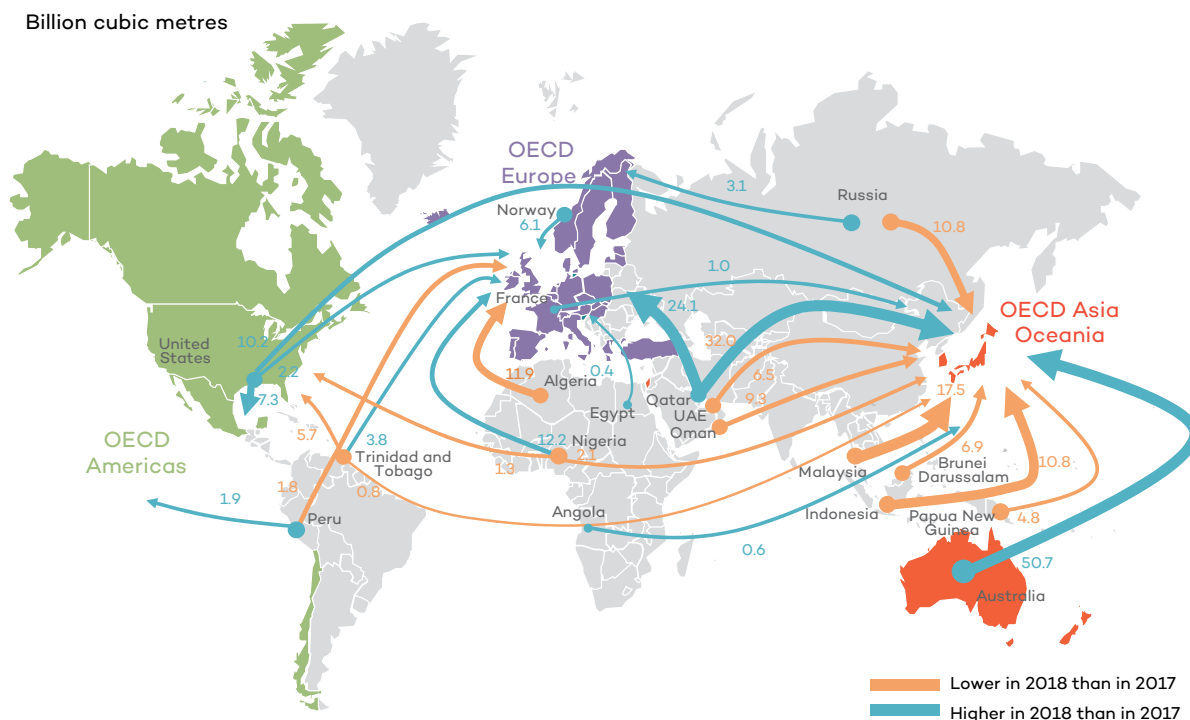
Lesson 2: Global gas trade is on the rise, with a quarter traded before use.

Over 1.2 trillion cubic metres of natural gas were traded internationally in 2018 (IEA, 2019c), accounting for about a quarter of total global production (IEA, 2018a). In 2018, global natural gas consumption grew by over 4.6% (IEA, 2019c), and global gas trade grew by 2.9% compared with 2017 (IEA, 2018b). The overall trend of moving from regulated prices to market pricing is expected to foster competition among suppliers in the coming years to cover growing global demand. It is notable that the number of territories with LNG import terminals grew from 9 in 2000 to 41 in 2018 (IEA, 2019d), with LNG now covering about one third of global natural gas trade (IEA, 2019c). LNG is expected to become the dominant form of natural gas entering international trade in the 2020s.

The IEA predicts that by 2040 global gas trade will still account for about 25% of production (IEA, 2018b). To cover increased use of natural gas, an average annual growth rate of 1.6% is expected for both production and trade until 2040, with natural gas overtaking coal as the second biggest source of energy by 2030 (IEA, 2019d). In terms of LNG, there is a growing diversity of sellers and of trading hubs, implying more competition in international trade. Again, it should be noted that these numbers may be overestimates and rely on a scenario, not forecasting.



Figure 6. LNG trade flows in 2018, billion cubic metres



Source: IEA, 2019c.

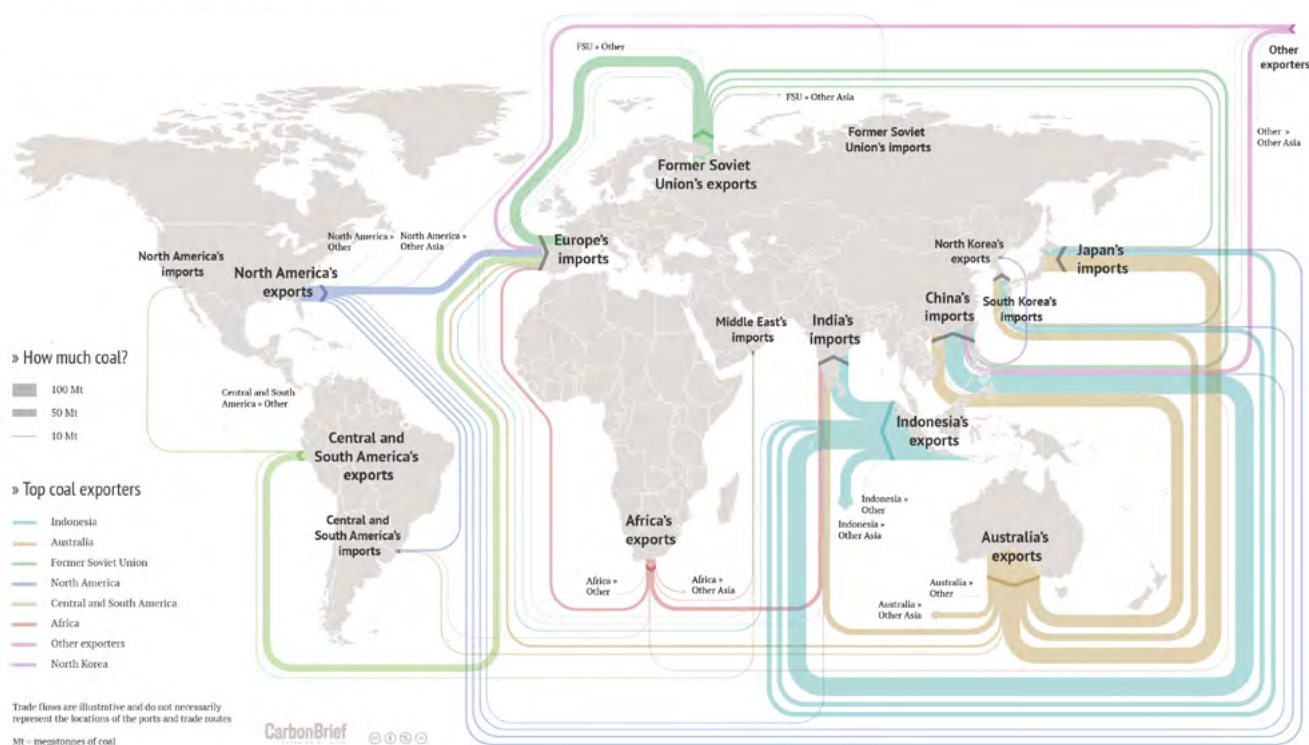
Lesson 3: While coal production is slowing down, coal trade is still increasing.

Over 1,350 million tonnes (Mt) of coal was traded in 2017, accounting for about one sixth of total global production (IEA, 2019e). While more and more countries are establishing pathways to move away from coal, current trade flows still facilitate its use (IEA, 2017). Today, global coal trade grows faster than consumption. In 2018, exports of coal rose by 4.2%. Coal exports have more than doubled (+131%) since 2000. Despite growing air pollution and climate change concerns related to coal consumption, exports in 2018 had still increased by 33% compared with 2010 (IEA, 2019e).

Unlike other fossil fuels, total coal trade is expected to slightly decline over the next two decades, from 1,102 million tonnes of coal equivalent (Mtce) in 2017 to 1,089 Mtce in 2040. If this forecast comes to pass, it is worrisome for the transition to more sustainable energy systems, which requires a much more rapid reduction of coal consumption (as well as a drastic reduction in oil consumption and, secondarily, natural gas consumption). In this scenario, trade in steam coal would decline due to its shrinking use in power generation, whereas trade in metallurgical coal would still increase (from 203 Mtce in 2017 to 346 Mtce in 2040) (IEA, 2018b).



Figure 7. Coal trade around the world in 2016



Source: Carbon Brief, 2016.

Lesson 4: Trade in refined oil products is on the rise, indicating conceivably large trade impacts of fossil fuel subsidies.

About 600 million tonnes of refined oil products was traded in 2016, accounting for about 15% of total global production (IEA, 2018a). In 2017, world refinery output increased by 2.0% compared with 2016; imports and exports of oil products grew by 2.6% and 2.9%, respectively (IEA, 2019a). While this growth may seem fairly low compared with crude oil and natural gas, the value of this trade is significantly higher than for crude fossil fuels (see below). Trade in electricity remains rather low, at around 350 TWh in 2016, accounting for about 1.4% of total global electricity production (IEA, 2018a). This is in part related to the historical development of national grids that are not well aligned, but also the result of electricity subsidies (KAPSARC, 2016).

4.2 Monetary Value of the Export of Fossil Fuels and Related Products

Lesson 5: World trade in fossil fuels and fuel products is worth more than USD 2 trillion.

The United Nations Statistics Division and the International Trade Centre (ITC) collect statistics on traded volumes and exported values for a whole range of products, categorizing them according to the 2-, 4- and 6-digit levels of the Harmonized System nomenclature

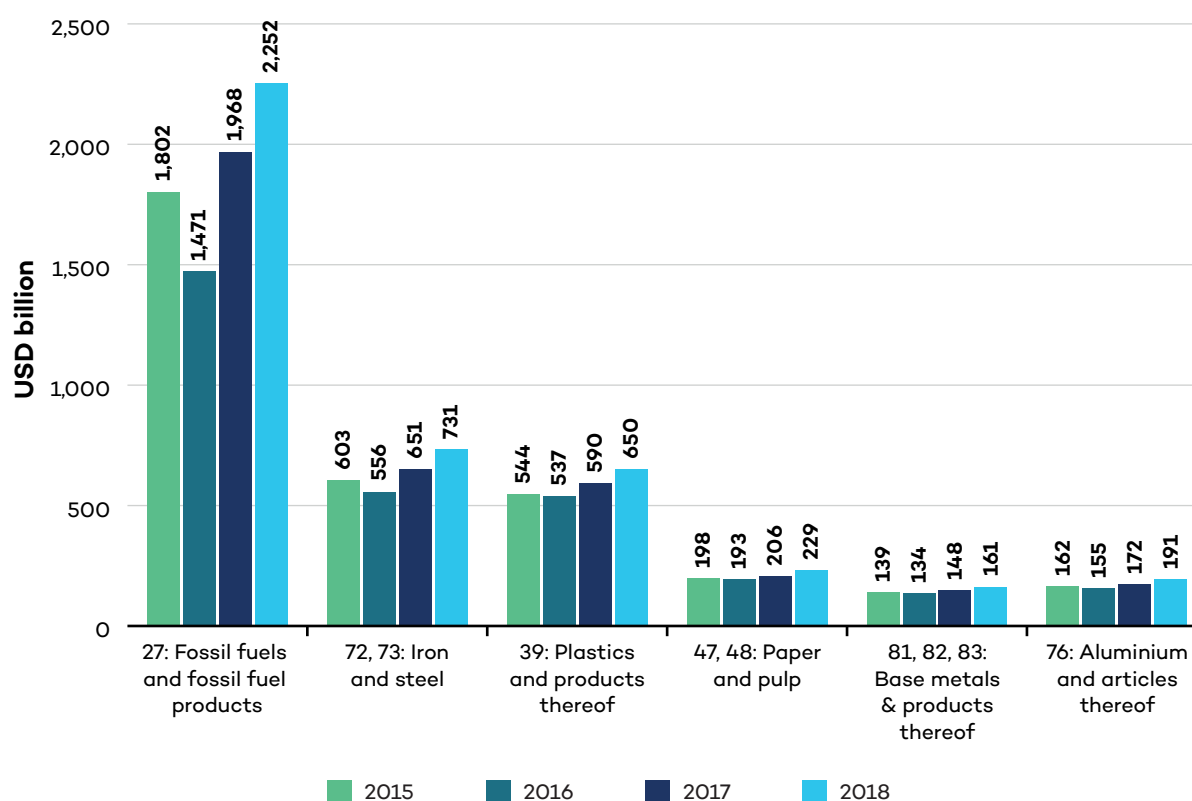


(HS). This allows for a strongly disaggregated overview of the values associated with trade in primary fossil fuels and refined products. These statistics could thus be used to qualitatively assess a country's engagement with international markets and see whether these markets link up to particular domestic producer or consumer subsidies.

An evaluation of current statistics on trade value shows that markets for fossil fuels and fuel products are colossal. Global exports of fossil fuels were worth a staggering USD 2.3 trillion in 2018, up from 1.5 trillion USD in 2016, though this difference can in large part be ascribed to international oil price movements. The most valuable market was the one for crude oil, which had a total export value of USD 943 billion in 2018. Second place was occupied by refined petroleum products, which had an export value of USD 779 billion. Natural gas came in third with a total export value of USD 299 billion (International Trade Centre, 2019).

Importantly, trade statistics also show that downstream products are widely traded. Iron and steel products, and basic articles fashioned from iron or steel, together account for the largest end-user market in terms of final-product export value among energy-intensive basic products, at USD 731 billion in 2018. This is followed by plastics and plastic products, global exports of which were worth USD 650 billion in 2018. Paper and pulp exports followed at USD 229 billion, aluminum and aluminum products at USD 191 billion and base metal and base metal products at USD 161 billion (International Trade Centre, 2019).

Figure 8. Exported value of upstream and downstream fossil fuels, fossil fuel products and energy-intensive basic products, by HS 2-digit category, 2015–2018 (USD billion)



Source: Authors' calculations based on ITC (2019).



Note: The numbers shown here only account for fossil fuel products within Chapter 27 of HS.

Lesson 6: International markets for fossil fuels and fuel products are widely dispersed.

Trade in fossil fuels and fossil fuel products is widely dispersed. The ITC uses a market concentration index that ranges from 0 to 1, with values closer to 0 indicating a highly competitive market (ITC, 2019). For the concentration of importing countries, the index is thus low when many countries import the product. Similarly, for the concentration of exporting countries, the index is low when many countries export the product. For all mineral fuels and mineral fuel products, both the import and export concentration index lie around 0.04. Markets for crude oil, natural gas and coal all have very low import concentration rates among importing countries, at 0.08, 0.07 and 0.09, respectively (ITC 2019). This indicates that such markets indeed have many importers. At the same time, they have fairly low export concentration rates as well, at 0.06, 0.07 and 0.2, respectively. This shows there are relatively many exporters for crude oil and gas, and less exporters for coal. The combined interpretation of these two indices is that there is a highly competitive market for fossil fuel products, with coal having less competitive density on the international market. As a result, competitive advantages between different national industries in such markets can indeed be influenced by domestic subsidies.

Importantly, markets for petroleum products such as gasoline and diesel are also hugely dispersed, with an import concentration rate of 0.03, one of the lowest of all products, and an export concentration rate of 0.05. This indicates that the trade impacts of fuel subsidies going to crude oil, natural gas and petroleum products are likely significant and large, determining who gains and who loses in terms of competitive advantage and market share. This is somewhat less the case for coal, which has a more limited number of exporters on the international market. This does not withstand the general conclusion that fossil fuel subsidies can substantially increase a national producer's sales volume relative to a no-subsidization scenario, at the expense of non-subsidized or less-subsidized producers in other countries. Other downstream markets also have low concentration index values. For example, iron and steel, and plastics and plastic products, have both import and export concentration indices of around 0.04 (ITC, 2019).

4.3 Largest Fossil Fuel Subsidies and an Illustration of Their Trade Impacts

Example 1: Producer subsidies reduce the marginal cost of production and thereby improve the competitive position of domestic fossil fuel producers.

The top 10 producer support measures as reported in the OECD Inventory of Support Measures for Fossil Fuels all foster the competitive position of domestic fossil fuel producers. The top 10 list shows that producer subsidies can come in many forms, from direct grants to reductions in or exemptions from taxes or royalties. Importantly, most of these measures target



key cost components of fossil fuel production, thereby reducing the marginal cost of production and enhancing the competitiveness of domestic producers vis-à-vis foreign competitors.

Table 3. Top 10 producer support measures in the OECD Inventory of Support Measures for Fossil Fuels in G20 countries (USD million, 2017)

	Name	Value in USD million
Russia	Reduced Extraction Tax for Oil Depending on Complexity of Production and Deposit Properties	3,615
Germany	Combined Aids in North Rhine Westphalia	1,371
Canada	Alberta Crown Royalty Reductions	1,106
Russia	Tax Reductions for Newly Developed Oilfields in Specific Regions	857
Russia	Reduced Extraction Tax for Investment into Exploration and Prospecting	699
Russia	Tax Reductions for Newly Developed Onshore Oilfields North of the 65th Latitude	671
United States	Taxable Per Barrel Credit	591
Germany	Manufacturer Privilege	389
Argentina	Strategic Co-ordination and Planning of the National Plan for Oil Investments	373
Japan	Capital Contributions for Exploitation Rights and Assets Investment	350

Source: OECD, 2019a.

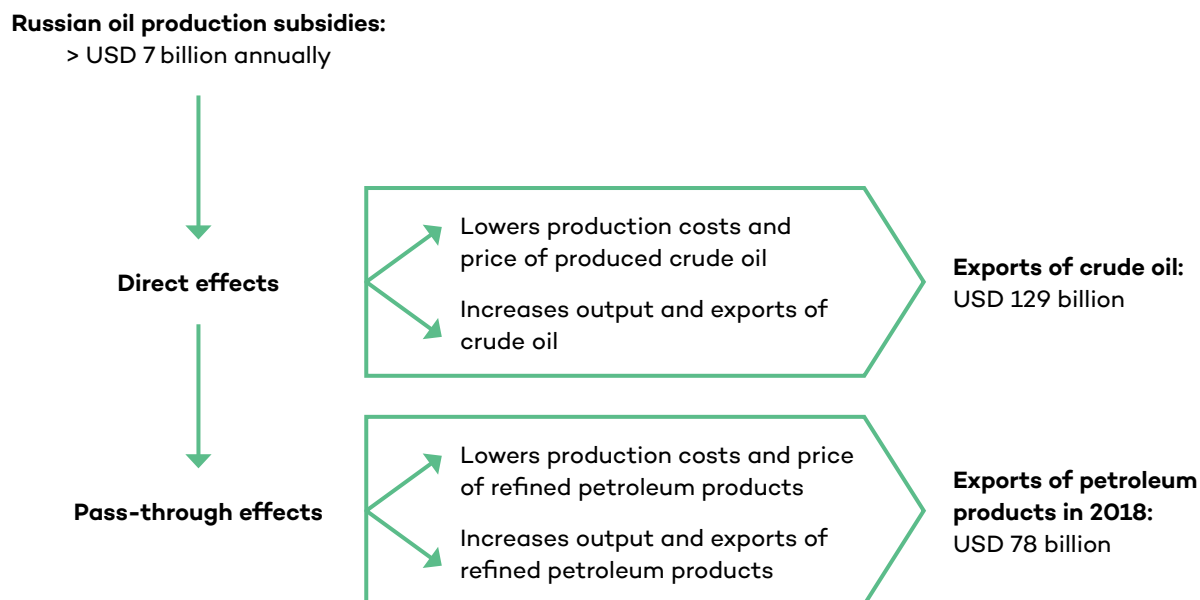
Notes: (1) These are tax expenditure subsidies that cannot be easily compared across countries as they are calculated using different taxation benchmarks. Certain subsidies can be used to correct rather than distort markets, something which a comparison of tax expenditure subsidies does not show. (2) Germany's combined aids in North Rhine Westphalia subsidy ended in 2018. (3) These are individual producer subsidies, which do not say anything about the total amount of fossil fuel subsidization in each country. The reported top subsidies are individual line subsidies as reported by the OECD, meaning that certain aggregates are not represented here. For example, the combined subsidy total of all types of coal that benefit from an excess of percentage over cost depletion amounts to USD 400 million.

For example, Russia has four producer support measures in the top 10, which all support the exploration and production of oil, especially in more remote regions or for lands with more difficult subsoils and production techniques. The direct effect of these producer subsidies is clear: they strengthen Russia's position in the battle for international market share for crude oil. As already discussed, the crude oil market is global, with half of total crude oil production traded before it is ever transformed, and the competition for global market share has only been increasing in recent years. In 2018, Russia exported USD 129 billion worth of crude oil (ITC, 2019). However, there are also clear pass-through effects on trade. Russia is a significant producer and exporter of refined products. In 2018, its exports of non-crude petroleum oils, including gasoline and diesel, were valued at USD 78 billion. That represented about 10% of the global export value of refined petroleum products (ITC, 2019). During the same year, Russian exports of plastics and plastic products were worth USD 3 billion. Figure 9 illustrates



these direct and pass-through effects (with the latter including only refined petroleum products, while excluding other energy-intensive downstream sectors).

Figure 9. Illustration of the trade impacts of Russian oil production subsidies



Source: Authors' diagram.

Example 2: Offering low energy prices above production costs does not necessarily qualify as a subsidy according to all definitions, but such pricing policies nonetheless can have significant trade impacts.

According to the IEA, the global level of fossil fuel consumption subsidies (which it estimates using a price-gap approach) went up from USD 302 billion in 2017 to USD 427 billion in 2018 (IEA, 2019f). The same data indicates that consumption subsidies reached USD 183 billion for oil, USD 143 billion for electricity, USD 99 billion for natural gas, and USD 3 billion for coal in 2018 (Watura & Zakia 2019). Logically, the top 10 consumption subsidies as reported by the IEA mostly accrue to oil and electricity. However, it should be noted that some of these subsidies are opportunity costs related to the underpricing of energy, but their price level may still be above production costs. This is, for example, the case for the oil subsidy



in Saudi Arabia. Such measures are therefore often referred to as price support or implicit subsidies. By making fossil fuels cheaper, nonetheless, these underpricing policies do of course lead to higher demand, like other consumption subsidies, and can have similar trade impacts.

Table 4. Top 10 fossil fuel consumption subsidies according to the IEA (USD billion, constant prices)

Country	Product	2015	2016	2017
Saudi Arabia	Oil	33	22	22
China	Electricity	7	27	21
China	Oil	13	15	17
Iran	Oil	17	11	16
India	Oil	15	11	14
Indonesia	Oil	9	6	12
Iran	Electricity	12	4	12
Russia	Gas	17	11	12
Mexico	Electricity	7	10	11
Saudi Arabia	Electricity	13	10	11

Source: IEA data retrieved from IEA Fossil Fuel Website, November 5, 2019.

Note: The estimation of these support measures uses a price-gap calculation based on an international and regional benchmark market price for oil and gas; when the end use price remains above production costs, these figures indicate an opportunity cost subsidy.

One could take the electricity subsidy in China as a clear example of a fossil fuel consumption subsidy with different types of trade impacts. A first trade impact is that subsidized prices increase domestic demand for electricity. Since China is by and large dependent on coal for most (69%) of its electricity generation, this consumption subsidy thus also encourages coal production in and outside China. While China might be the largest coal producer in the world (3.4 billion tonnes in 2018), it is also the world's largest importer, at 295 million tonnes in 2018 (IEA, 2019e). There are also pass-through effects of the electricity subsidy. For example, China's exported value of aluminum and aluminum products—a sector that is electricity-intensive—was about USD 27 billion in 2018, representing 14% of global exports in the metal (ITC, 2019). The OECD (2019) has shown the impact of subsidized electricity on China's rising exports of aluminum, indicating that electricity subsidies have been an important factor explaining the export competitiveness of this sector.

4.4 Potential Trade Impacts of Fossil Fuel Subsidies in Various Sectors

As mentioned earlier, fossil fuel subsidies can directly or indirectly reduce the marginal cost of the production of crude energy products, transformed energy carriers or energy-intensive products. As a result, industries within the subsidizing jurisdiction can see their competitive advantage vis-à-vis non-subsidized foreign products increased, thereby providing them with an



opportunity to capture more market share in domestic or international markets compared to a no-subsidy baseline.

Comparing a number of key indicators presented in Table 5 suggests that the trade impacts of fossil fuel subsidies are likely the largest when those subsidies affect upstream markets, as well as markets for petroleum and energy-intensive products and energy-intensive products. While the size of the effect would depend on the form of the subsidy and the prevailing market price in every specific case (see for example Erickson et al., 2017), trade openness in these sectors is generally very high, with large volumes traded for large sums of money. If fossil fuel subsidies affect the marginal cost of production of these products, then it is very likely that subsidies allow their producers to gain a competitive edge in these highly competitive and valuable markets. As shown above, many producer subsidies reduce the cost of investment, but can also lower the marginal cost of production and thus affect international trade significantly.

Table 5 shows the annual trade volume of various fossil fuels and related types of products as a percentage of global production. This metric indicates how much of a product (crude oil, for example) is traded on international markets before it is consumed (for example 50%). It then shows the annual trade value, indicating the revenue generated by exports on the international market. In comparison, the total value of all product exports worldwide in 2018 was USD 19 trillion. This means that the fossil fuel products trade alone—excluding energy-intensive industries—represented more than 10% of all worldwide trade value. Finally, Table 5 shows the level of competitive density on these markets, before indicating the key trade impact fossil fuel subsidies can have on these types of products.

Table 5. Affected markets and trade exposure

Affected market	Annual trade volume (% of global prod.)	Annual trade value (USD, 2018)	Competitive density	Key trade impact
Upstream oil	~ 50%	943 billion	High	Battle for market share
Upstream gas	~ 25%	299 billion	High	Battle for market share
Upstream coal	~ 16%	124 billion	Medium	Battle for market share
Electricity	Very small	35 billion	Low	Obstruction of trade
Petroleum products	~ 15%	779 billion	Very high	Battle for market share; smuggling of refined fuels
Energy-intensive industry	Industry-dependent	> 1 trillion	Very high for key industries	Battle for market share
Electricity-intensive industry	Industry-dependent	> 300 billion	Very high for key industries	Battle for market share



Source: Authors, based on statistics from the IEA (various dates, see references in above sections) and ITC (2019)

Notes: (1) Estimates of trade value represent minimum values since they are based on a conservative aggregation of HS6 product identification codes.; (2) Competitive density is about the concentration of both importing and exporting countries, with a high density (corresponding to a low concentration rate) indicating more dispersed trade; (3) Battle for market share is about the battle within markets for fossil fuels and relevant products, but also against potential alternatives such as renewable energy (for example by crowding out investment).



5.0 Options for Engaging More With Fossil Fuel Subsidies at the WTO

In recent years, increased attention has been given to the role the global trade system could play in promoting the reform of fossil fuel subsidies, mostly—but not exclusively—based on the need to address their harmful environmental impacts. Much of this discussion has focused on the WTO. The organization’s experience in disciplining subsidies, its wide and diverse membership, the enforceability of its rules and the importance of trade-related policies for supporting sustainable development have all been highlighted as reasons why the WTO is an appropriate forum for effectively addressing fossil fuel subsidies (Pereira, 2017; Trachtman, 2017).

The WTO already has rules in place—most importantly under the organization’s Agreement on Subsidies and Countervailing Measures (ASCM)—which discipline fossil fuel subsidies to the extent they distort trade. Beyond two particular types of prohibited subsidies,⁵ any government support measure can be challenged under the ASCM if it meets three criteria: (a) it fits the agreement’s definition of a subsidy, (b) it is provided specifically to an enterprise or industry or group of enterprises or industries; and (c) it causes adverse trade effects to the interests of another WTO member. In light of the widespread trade impacts both production and consumption subsidies can have, as highlighted in previous sections, this means that existing rules can be brought to bear on such measures to the extent these conditions are fulfilled.

It is clear, however, that WTO rules have not been effective at reducing the widespread use of fossil fuel subsidies. It has also been noted that while various legal cases on government support to renewable energy have been brought to the WTO’s dispute settlement body, fossil fuel subsidies have so far evaded litigation (Steenblik et al., 2018; Verkuijl et al., 2019). To explain this absence of WTO trade disputes using subsidy rules to challenge fossil fuel support measures, experts have highlighted both political and legal factors. In particular, it has been noted that in the case of many fossil fuel subsidies, it can be particularly difficult to meet some of the legal tests required to successfully challenge a measure under the ASCM – i.e., proving that a subsidy is “specific” and that it has “adverse effects” on another WTO member’s interests (Das & Bandyopadhyay, 2016; Verkuijl et al., 2019). Despite the important trade impacts fossil fuel subsidies can have, it thus seems that current WTO rules are unable to really constrain their use.

In light of this, a number of options have been proposed regarding how the WTO could start engaging more meaningfully with fossil fuel subsidies and effectively support their reform (Wooders & Verkuijl, 2017; ICTSD, 2018; Verkuijl et al., 2019; Das et al., 2018).⁶ The main options—or types of options—in the WTO toolbox, which have varying degrees of ambition and political feasibility, are presented below.

⁵ Subsidies contingent on export performance and subsidies contingent upon the use of domestic over imported goods.

⁶ This section draws substantially on these four sources, which are the most comprehensive attempts at compiling various options for addressing fossil fuel subsidies through the global trade system, in particular at the WTO.



Option 1: Improve Transparency

A first type of effort in addressing fossil fuel subsidies at the WTO would consist of actions taken with the aim of improving the transparency around such support measures. This would enhance awareness about and the visibility of subsidy policies and measures benefiting fossil fuels, fostering a better understanding among WTO members of the global fossil fuel subsidies landscape as a basis for efforts aimed at addressing them.

WTO members have an obligation, under the ASCM, to notify all “specific” subsidies that they grant or maintain.⁷ Compliance with subsidy notification obligations is, however, notoriously low (Wolfe, 2013), including on fossil fuel subsidies specifically. Casier et al. (2014), for example, have observed that between 2008 and 2013, the number of fossil fuel subsidies notified to the WTO was only a tenth of the support measures contained in the OECD Inventory of Support Measures for Fossil Fuels—although it should be noted that the scope of measures included in the OECD inventory is broader than some conceptions of a “subsidy” (OECD, 2015), including the ASCM’s definition. This situation thus calls for an improvement in how members disclose fossil fuel subsidies at the WTO. Various ideas have been suggested in that regard (ICTSD, 2018; Verkuijl et al., 2019).

A first idea to promote better transparency would be for a group of interested WTO members to voluntarily commit to disclose their fossil fuel subsidy programs in a systematic and comprehensive way in their SCM notifications. This could be most effectively done through the use of a common template (Steenblik & Simón, 2011), which would help members to notify measures in a consistent and user-friendly way. Members could also agree to include a specific section on fossil fuel subsidies in their notifications, allowing for an easy search for relevant information and comparison across notifications. Discussion within the WTO Committee on Subsidies and Countervailing Measures (SCM Committee) and the Committee on Trade and Environment (CTE) has also been highlighted as providing a means for increasing transparency on subsidies in the WTO context (Wolfe, 2013).

A second idea would be to make more use of counter-notifications (Asmelash, 2017), in accordance with Article 25.10 of the ASCM. This tool allows a WTO member to bring another member’s subsidies to the attention of the SCM Committee when it considers that such measures have not been appropriately notified—and provided the situation is not promptly rectified once it was brought to the attention of the concerned member. The use of counter-notifications, however, is infrequent (Collins-Williams & Wolfe 2010), which may be explained by the important information-gathering capacity and the resources it requires. A related idea would be to ask the WTO Secretariat, similarly to what has happened in other areas (Wolfe, 2013), to play a more active role, potentially by tasking them to provide additional information on members’ fossil fuel subsidies to help fill in the blanks.

A third idea to shed more light on fossil fuel subsidies at the WTO would rely on the organization’s Trade Policy Review Mechanism (Trachtman, 2017; Asmelash, 2017; Casier et al., 2014), the objective of which is precisely to achieve “greater transparency in, and understanding of, the trade policies and practices of Members” through regular reviews

⁷ In the ASCM context, specific means provided specifically “to an enterprise or industry or group of enterprises or industries” (WTO, 1994).



(WTO, 1989). Trade policy reviews are based on extensive reports written by the WTO Secretariat and the member whose policies are under review. In a similar fashion to how subsidy notifications could be improved, interested WTO members could voluntarily commit to including fossil fuel subsidies in their own reports with a specific section on the topic. The WTO Secretariat could also aim at consistently including fossil fuel subsidies in its own reports, which could be instructed explicitly by the Trade Policy Review Body.

For the three ideas mentioned above, WTO members and the WTO Secretariat could seek to make use of information sources such as peer reviews under the G20 and the Asia-Pacific Economic Cooperation (APEC), the OECD Inventory of Support Measures for Fossil Fuels, upcoming reporting against the SDGs' fossil fuel subsidy-focused target (target 12.C), or information provided by NGOs, as much as possible. Members could reflect on possible ways to maximize such potential use of third-party information.

Finally, a fourth idea would consist of strengthening notification requirements, which would likely necessitate a change in existing rules. Bacchus (2018), for example, has suggested that WTO members could be required to “disclose the details of all their fossil fuel subsidies.” This would add to current rules by highlighting the importance of fossil fuel subsidies in particular and introducing an obligation to notify non-specific fossil fuel subsidies, which would be new. Another idea would be to attach potential sanctions to non-compliance with notification obligations, which could take various forms (WTO, 2019c).

Option 2: Build Capacity to Identify, Understand and Reform Subsidies

Although fossil fuel subsidy reform has received increasing attention over the last decade in various fora (including to some extent the WTO) it is still a relatively new topic on international, regional and national policy agendas. It can also be a particularly complex topic for neophytes. In light of this, capacity-building activities and processes could play a key role in helping government officials to tackle this complexity and supporting an enabling environment for addressing fossil fuel subsidies effectively, especially if associated with enhanced transparency. There are a variety of ways in which capacity building could be useful in a WTO context (Verkuijl et al., 2019).

A prerequisite to any potential reform effort, as well as to improved transparency, is the identification of existing subsidy programs. However, some countries, in particular from the developing world, often face capacity challenges in doing so. Lack of capacity has been identified as one of the key reasons behind the low rate of subsidy notification at the WTO (Wolfe, 2013). Building WTO members' capacity to identify, measure and notify fossil fuel subsidy measures could thus be essential in that regard, including through technical assistance and training activities. The Institute for Training and Technical Cooperation (ITTC), whose task is to coordinate the WTO's technical assistance, could, for example, be tasked with providing some support on this topic. Potential cooperation with other relevant organizations such as the UN Environment Programme could also be explored.

In addition, and perhaps most importantly, capacity-building activities could help build a better understanding among all WTO members about the environmental, social, economic



and trade-related impacts of fossil fuel subsidies. This could help shed light on the real costs of such measures and promote a common and interactive learning process that would raise awareness about the potential benefits of reforming them. Here, capacity building could take the shape of dedicated discussion sessions on fossil fuel subsidies in a relevant WTO body, possibly under the CTE or the SCM committee, with substantive input provided by WTO members (based on their own experience), the WTO Secretariat, and other organizations, including NGOs.

Fundamentally, such discussions could also allow WTO members to share potential lessons they have learned from their own efforts for reforming fossil fuel subsidies domestically. While successful reform has been implemented in a number of countries (Gerasimchuk et al., 2018; Merrill & Quintas, 2019), other national experiences also show that reducing or eliminating energy subsidies can involve particularly significant political sensitivities and lead to social unrest (Clements et al., 2013; Roth & Gerasimchuk, 2019; Funke & Merrill, 2019). Experience sharing among members could thus be instrumental in allowing them to understand under what circumstances, and how, reform can be designed and implemented effectively. One key factor to do this would be to exchange best practices on possible ways to protect negatively affected groups and support them through the transition away from fossil fuel subsidies. For such discussions to be truly meaningful, they should involve more than trade delegates. WTO members would need to make sure that the right representatives (i.e., those that are actually in charge of subsidy policies) came to Geneva to participate.

The fact that capacity challenges are particularly acute in developing countries would deserve particular attention. It has been highlighted that many developing countries currently lack the necessary technical and institutional capacity to move away from fossil fuel subsidies without harming the most vulnerable: this is a complex task (Asmelash, 2017). However, effective social impact mitigation policies are available (Beaton et al., 2013). Capacity-building and technical assistance could thus help address these specific constraints and needs. To do so, WTO members could seek to include fossil fuel subsidy reform in existing assistance programs. For example, it has been suggested that the Enhanced Integrated Framework, a multi-donor and multi-agency program delivering trade-related assistance to least developed countries, could be used (ICTSD, 2018).

The two first options mentioned here—improving transparency and building capacity—are closely interlinked. Indeed, improved transparency around fossil fuel subsidies would help support a better understanding of the scale and potential impacts of such measures. Conversely, experience and information sharing in the context of capacity-building discussion sessions would also help shed light on particular measures and types of subsidies. WTO members could explicitly aim at maximizing these synergies.

Option 3: Pledge and Review

A more ambitious approach would be for WTO members to pledge to phase out—or reduce—fossil fuel subsidies and to monitor the progress made by each other toward meeting this voluntary goal through a credible review process (Verkuijl et al., 2019). Such a review would be based on reports by members, in which they would disclose their subsidies and potentially highlight their reduction efforts. This option would thus necessarily also involve an element



of increased transparency. It has also been suggested that review could be undertaken either under an appropriate WTO committee—possibly the SCM committee or the CTE⁸—or under the TPRB (ICTSD, 2018).

This type of approach would not be completely new, as peer review processes focused on fossil fuel subsidies already exist in the contexts of the G20 and APEC, allowing members to track progress toward meeting pledges made in these fora (Gerasimchuk et al., 2017). Taking advantage of this, WTO members could design a process that would build on some of the lessons learned from these existing experiences, building on their strengths while also trying to address their potential weaknesses. They could also reflect on how best to establish links with these processes.

Importantly, a WTO-based pledge-and-review process would have the obvious advantage of a much wider pool of potential participants. With the WTO's 164 members, its potential coverage could be close to universal. However, this approach would not need to be multilateral. It could first be launched by a group of interested WTO members—with obvious candidates being the Friends of Fossil Fuel Subsidy Reform, as well as G20 and APEC members—and potentially expand in a gradual way to the wider membership as other members learn about the process by watching it operate among original participants.

While the pledges to phase out fossil fuel subsidies made in the G20 and APEC are general and common to all members, WTO members could decide to introduce more specificity (and potentially variability) in their pledges. They could set specific objectives in terms of reduction timelines and prioritize some types of subsidies, for example, those that have particularly strong trade and environmental impacts. Members could also each voluntarily pledge to meet different specific objectives, based on their own circumstances and capacity, in the time frame they consider appropriate. Such a flexible approach, which calls to mind the Paris Agreement on climate change and its nationally determined contributions, would allow for taking into account the specific conditions of developing countries. WTO members could also use this process to exchange mutual concessions, possibly helping to drive up the overall level of ambition.

Option 4: Clarify How Existing Rules Should Apply

Another type of option that has been suggested would consist of bringing some sort of clarification regarding how existing WTO rules should apply in relation to fossil fuel subsidies (ICTSD, 2018), which could take at least two shapes.

First, WTO members could adopt an authoritative interpretation of current rules on subsidies,⁹ which are primarily found in the ASCM. As mentioned above, for a specific measure to be found in breach of these rules, it must be shown that such a measure constitutes a subsidy; that it is “specific”; and that it causes adverse trade effects for another WTO member. An interpretative understanding could seek to bring more clarity regarding

⁸ It should be noted that for these committees to be able to perform this task, WTO members would need to instruct them to do so. And here again, members should also ensure the participation of the right representatives to discuss fossil fuel subsidies.

⁹ Such a decision would be taken under Article IX.2 of the WTO Agreement.



these three elements and the way they apply to fossil fuel support measures specifically. It could, for example, clarify whether some specific types of support should be considered subsidies, and under what circumstances they should be considered as being specific (Wooders & Verkuijl, 2017).

Second, members could use the possibility provided by Article IX.3 of the WTO Agreement to waive some WTO obligations under exceptional circumstances. One idea would be to waive the requirement for specificity to be able to challenge fossil fuel subsidies under the ASCM (Trachtman, 2017), which could be justified on the grounds that some of these subsidies have significant trade and environmental impacts despite not being specific. It has also been suggested that a waiver could be adopted for measures aimed at supporting clean energy, but made conditional on the elimination or reduction of environmentally harmful subsidies such as fossil fuel subsidies (Howse, 2014).

These two possible options could go some way in bringing more certainty about how current rules should apply to fossil fuel subsidies and potentially contribute to incentivizing their elimination in some circumstances. It is clear, however, that they would not have the same potential strength as new rules designed with the specific objective of eliminating such subsidies.

Option 5: Negotiate New Subsidy Disciplines

The most ambitious, likely the most effective, but perhaps also the most politically challenging way of addressing fossil fuel subsidies at the WTO would be through the negotiation of new binding subsidy disciplines. Variations of this approach have been proposed by a number of different experts (Das & Bandyopadhyay, 2016; Horlick & Clarke, 2016; Bacchus 2016; Pereira, 2017), with the same ultimate objective in all cases: prohibiting fossil fuel subsidies in general, or some fossil fuel subsidies that are considered particularly harmful based on their trade-related or environmental impacts. In legal terms, the two main ways to establish such disciplines would be amending the existing ASCM, possibly with a separate annex, or concluding a stand-alone separate agreement on fossil fuel subsidies, although other options also exist (see Bartels & Morgandi, 2017).

As not all fossil fuel subsidies are equally harmful and trade-distorting, any new disciplines would likely seek to include some differentiation in that regard (ICTSD, 2018; Verkuijl et al., 2019). Should WTO members choose to go for a simple prohibition of all subsidies for the exploration, production or use of fossil fuels, they could agree on a number of carefully delimited exceptions, potentially in the form of a “green box” of allowed subsidies. A safeguard could also be attached to this category to ensure that rules are not circumvented, and exceptions do not undermine the effectiveness of new disciplines. Another approach would be to simply focus a prohibition on a list of specific types of fossil fuel subsidies that members think should be eliminated in priority.

WTO members could also choose to prohibit subsidies based on their effects, an approach that has for example long been part of WTO negotiations on fisheries subsidies (see WTO, 2018). Taking inspiration from the history of these negotiations, it has been suggested that disciplines on fossil fuel subsidies could use all these options and mirror the ASCM’s three



original categories of subsidies by including prohibited subsidies, actionable subsidies and non-actionable subsidies (Pereira, 2017).

Another approach that has been discussed in the fisheries subsidies negotiations, and which could be used for fossil fuel subsidies, is the idea of capping subsidies. Instead of an outright prohibition, this option would consist of allowing WTO members to continue disbursing fossil fuel subsidies but only up to a certain individual cap, which could be defined accordingly to various modalities or negotiated among WTO members (see for example Trachtman, 2017; WTO, 2019a; WTO, 2019b). A capping approach could also be combined with stricter prohibitions and include reduction commitments over time.

While an immediate elimination of fossil fuel subsidies would undoubtedly be difficult to implement, WTO members could agree on a transition period that would allow for their gradual phase-out (Bacchus, 2016). Ambition could also be scaled up over time, with the prohibition first applied to a subset of subsidies and progressively expanding to others. It has been suggested, for example, that production subsidies could be prohibited first, taking into account the importance that consumption subsidies can have for the most vulnerable segments of the population (Horlick & Clarke, 2016), particularly in developing countries.

More generally, a key question for WTO members would be to determine how new disciplines would apply to developing and least developed countries (Trachtman, 2017; Pereira, 2017). The importance of special and differential treatment was recognized by the signatories of the joint ministerial statement on fossil fuel subsidies at the last WTO ministerial conference in Buenos Aires, who highlighted that “reform needs to take fully into account the specific needs and conditions of developing countries and minimize the possible adverse impacts on their development” (WTO, 2017). Available instruments that could be used include exemptions from the new rules, longer transition periods, as well as targeted technical assistance and capacity building.

Finally, disciplines on fossil fuel subsidies could also be included in a broader sectoral agreement on sustainable energy, covering both fossil fuel and clean energy (ICTSD, 2011; Kennedy, 2012; Marhold, 2017). Such an agreement would aim to facilitate the necessary and urgent transition toward cleaner energy systems, ensuring that multilateral trade rules align with the Sustainable Development Goals. A sustainable energy agreement would go much beyond fossil fuel subsidies and include rules in other areas, in particular, to facilitate trade in goods and services used for renewable energy production, distribution and storage.

A Palette of Options

In light of fossil fuel subsidies’ important implications from a trade and trade policy perspective, as highlighted in previous sections, this section has emphasized that there are many ways for engaging more with fossil fuel subsidies and their reform in the WTO context. The various options presented constitute a range of possibilities that are not mutually exclusive. They could be combined in various ways, including by starting with options that seem to be less challenging, at least in the short term, and gradually increasing the level of ambition (Verkuijl et al., 2019). WTO members could, for example, start with efforts to



increase transparency and build capacity before engaging in a voluntary pledge-and-review process and ultimately agreeing to new binding subsidy disciplines.

Any progress on the issue of fossil fuel subsidies in the WTO context would necessitate genuine political commitment. As noted above, however, some of the options presented would not require consensus among all WTO members to start moving forward. In that regard, the joint statement on fossil fuel subsidy reform signed at the WTO's Eleventh Ministerial Conference in Buenos Aires is a signal that some members share a keen interest in doing so. The recent launch of negotiations on the Agreement on Climate Change, Trade and Sustainability (ACCTS) among six countries (Costa Rica, Fiji, Iceland, New Zealand, Norway, and Switzerland) is also an interesting development in that regard, as one of their objectives is to establish disciplines to "eliminate harmful fossil fuel subsidies."¹⁰ This initiative could inspire broader efforts in this area, including at the WTO. The WTO's upcoming Twelfth Ministerial Conference, which will take place in Nur Sultan, Kazakhstan, will provide the next opportunity for interested WTO members to show their commitment to advance the fossil fuel subsidy reform agenda at the WTO.

¹⁰ The statement on the launch of the negotiations is available at <https://www.beehive.govt.nz/sites/default/files/2019-09/ACCTS%20joint%20leaders%20statement.pdf>.



6.0 Conclusion

This paper aimed at exploring the multiplicity of trade impacts generated by the use of fossil fuel subsidies. To do so, it outlined the various pathways through which fossil fuel subsidies can affect competitiveness and trade at various stages of fossil fuel product value chains, before providing an empirical overview of key indicators that suggests those trade impacts are likely both deep and widespread. Fossil fuel subsidies foster the competitiveness of domestically produced products vis-à-vis competitors, whether in the domestic market (by inhibiting imports) or in the international market. There are three main categories of products that benefit from fossil fuel subsidies and for which trade impacts are likely very significant since these products have large markets, high export values and dense competition. One can consequently draw three conclusions:

1. The impacts generated by the direct effects of producer subsidies on trade of primary energy products (such as crude oil, natural gas and coal) are likely very high, influencing markets where a large part of products are traded on international markets before consumption, with a total trade value of at least USD 1.3 trillion.
2. The impacts generated by the direct and pass-through effects of producer subsidies and the direct effects of consumer subsidies on markets for refined energy carriers (e.g., gasoline, diesel and jet kerosene) can be high, influencing markets in which trade accounts for a significant share of global consumption, with a total trade value of at least USD 800 billion.
3. The impacts generated by the pass-through effects of producer subsidies and the direct and pass-through effects of consumer subsidies on markets for energy-intensive non-energy products (e.g., iron and steel, plastics) are likely very high, influencing markets that are worth at least USD 1.3 trillion—as much, if not more, than the export value of primary energy products.

These three main categories of trade impacts highlight the fact that non-subsidized (or less-subsidized) producers of the same products can be negatively affected by fossil fuel subsidies, but the effects can also extend to other markets. These support measures also hinder alternative energy products from entering domestic markets, such as for goods associated with renewable energy, and more generally weaken their competitiveness on international markets. At a time when shifting entire energy systems in a more sustainable direction is more important than ever, this negative impact on the competitiveness of renewables is particularly concerning.

There are also other ways in which fossil fuel subsidies can affect trade, which appear to be significant but remain under-researched. These include the smuggling of fossil fuels and related products across borders, the impact on non-subsidizing countries that carry the cost of price appreciation due to increased global demand because of consumer subsidies, and the total impact of price controls on global GDP. Fossil fuel subsidies can also hamper the development of cross-border electricity trade.



Overall, a key conclusion from this paper is that, while there are a number of studies looking at the impacts of fossil fuel subsidies on domestic economies, much more empirical and quantitative research is needed to quantify the impact of fossil fuel subsidies on trade. The paper shows the multiplicity of ways in which these subsidies can affect producers' competitiveness and trade, using empirical evidence to shed light on the potential scale of these various impacts. It is clear, however, that more granular analysis is needed to better understand the exact trade impacts of various types of fossil fuel subsidies. This would constitute an important area for future research.

Finally, our analysis clearly highlights the relevance of fossil fuel subsidies from an international trade policy perspective, in particular for the WTO. Despite clear indications of likely sizable trade impacts of fossil fuel subsidies, the WTO has barely touched the tip of the iceberg. Not only have current rules proved ineffective at disciplining the use of fossil fuel subsidies, but there is also a critical lack of transparency around such support measures. Various options exist to foster more engagement on fossil fuel subsidy reform at the WTO. These options are not mutually exclusive, and many do not require a multilateral consensus to be operationalized. The key question is whether this issue will gather enough political traction among WTO members to see progress in the WTO context.



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Annex I: Examples of Trade Impact Pathways of Oil, Gas and Coal Consumption Subsidies

Table A1. Trade impact pathways of oil, gas and coal consumption subsidies

Affected Markets	Potential Trade Impacts
General oil, gas and coal consumption subsidies	
Economy-wide	When many countries have price controls and there is an increase of international demand for fossil fuels, then the associated international price increase is carried by the economies of countries with liberalized pricing regimes, both via inputs for firms and net purchasing power of consumers.
Downstream products	When governments subsidize raw fossil fuel products to all downstream consumers, then domestic sectors using these fossil fuels as feedstock will gain a competitive advantage vis-à-vis producers in other, non-subsidizing countries.
Like products	Subsidized products can be smuggled to third markets where unsubsidized products have their competitive position negatively affected.
Gasoline consumption subsidies	
Market-priced gasoline	Subsidized gasoline can be smuggled across borders to jurisdictions with higher priced gasoline. This would undermine competitively priced gasoline on the international market.
Electric vehicles	Subsidized gasoline can lead consumers to choose gasoline-based vehicles, undermining the competitiveness of electric vehicles produced in whole or in part in third economies.
Ethanol	In the absence of blending mandates, subsidized gasoline negatively affects the competitive position of ethanol as a substitute transport fuel.
Economy-wide	Gasoline use is dominated by private transport, which can be important for short-distance travel of commodities such as grains to remote areas within a given countries. This can enhance the competitiveness of such supply over the import of like products from nearer regions within other economies.
Diesel consumption subsidies	
Market-priced diesel	Similar to gasoline consumption subsidy effect – see above.
Electric vehicles	Similar to gasoline consumption subsidy effect – see above; only in markets where passenger transport is diesel-driven (e.g., EU, India).
Biodiesel	Similar to gasoline consumption subsidy effect – see above.



Affected Markets	Potential Trade Impacts
Industries relying on diesel as transport fuel	Subsidized diesel can be used as an input for various industries including freight transport, fisheries, agriculture, and heavy equipment in construction, mining and forestry. Consumption subsidies reduce the production costs of these industries and positively affect their competitive position vis-à-vis imports on the domestic market or on the international market.
Distributed and other backup generators	Subsidized diesel can be used in backup electricity generators, adversely impacting the competitiveness of decentralized renewable energy or backup generators fueled by other resources. Subsidized diesel benefits generators over alternatives produced in whole or in part in other economies.
Kerosene consumption subsidies	
Diesel and gasoline	Subsidized kerosene has often been used to adulterate diesel and gasoline, offsetting diesel and gasoline imports to cover that demand.
Solar lanterns	Subsidized kerosene is used as lighting fuel, especially in rural areas. This can offset a potential market for solar lanterns produced in whole or in part in other economies.
Other jet fuels	Subsidized kerosene can increase the competitiveness of kerosene vis-à-vis other jet fuels such as naphtha-type jet fuels, produced in whole or in part in other economies.
Other cooking fuels and cooking infrastructure	Subsidized kerosene can enhance the competitiveness of kerosene vis-à-vis other cooking fuels such as LPG and natural gas, potentially provided in whole or in part from other economies. It also affects the type of infrastructure used for cooking, particularly vis-à-vis electric stoves.
Other oil subsidies	
Plastics	Naphtha is a primary component of plastics production. Subsidized naphtha can offset the market share of plastics produced with natural gas liquids or prohibit the introduction of non-fossil fuel-based plastics.
LPG subsidies	
Other cooking fuels and cooking infrastructure	Subsidized LPG can enhance the competitiveness of LPG vis-à-vis other cooking fuels, potentially provided in whole or in part from other economies. It also affects the type of infrastructure used for cooking, particularly vis-à-vis electric stoves.
Diesel and gasoline	Subsidized LPG can also be used to adulterate diesel and gasoline, offsetting diesel and gasoline imports to cover that demand.
Alternative water heaters	In countries where LPG is used for water heaters, subsidized LPG can affect the competitiveness of alternative water heaters (such as solar water heaters, heat pump water heaters, gas-fired tankless water heaters) produced in whole or in part in other economies.



Affected Markets	Potential Trade Impacts
Alternative transport fuels including electric vehicles	In countries where LPG is used for transport, subsidized LPG can affect the competitiveness of alternative fuels such as biofuels, gasoline and diesel, but also of electric vehicles.
Petrochemical feedstock	
Chemical industry	Petrochemicals are particularly used in the chemicals sector, lifting the competitiveness of the industry in a jurisdiction with subsidized petrochemical feedstocks as opposed to the chemicals industry in a non-subsidizing economy.
Natural gas subsidies	
Fertilizer	Natural gas is the key source of fertilizers in the form of ammonia and urea. Subsidized natural gas prices can thus benefit fertilizer production vis-à-vis foreign competitors that rely on non-subsidized prices.
Electricity	Subsidized gas can increase the market share of gas-fired power producers in the electricity market vis-à-vis power producers relying on other input such as coal, wind, solar and hydro.
Plastics	Natural gas liquids are a primary component of plastics production. Subsidized NGL can offset the market share of plastics produced with naphtha (a crude oil refining product) or prohibit the introduction of non-fossil fuel-based plastics.
Steel and paper production	Natural gas is used for process heating for industrial applications, especially in the steel and paper sectors.
Petrochemicals	Natural gas is used for the production of petrochemicals, making it cost-competitive vis-à-vis petrochemicals produced in non-subsidizing states.
Coal subsidies	
Cement	Subsidized coal can lower the manufacturing costs of cement production. However, as cement is consumed close to the place of production, it is unlikely that coal consumption subsidies have a large trade impact in this area.
Iron & steel	Steel production relies on the use of iron ore, coking coal and recycled steel. If coal is subsidized, it can favour domestic production over coal produced abroad, potentially using other, cleaner methods relying on electricity and recycled steel. Only 30% of world steel production relies on manufacturing processes using less coal.
Electricity	Subsidized coal can increase the market share of coal power producers in the electricity market vis-à-vis power producers relying on other input such as natural gas, wind, solar and hydro.



Annex II: Fossil Fuel Support Measures

Table A2. OECD Matrix of fossil fuel support measures with examples

		Transfer Mechanism (how a transfer is created)					
		Direct transfer of funds	Tax revenue forgone	Other government revenue foregone	Transfer of risk to government	Induced transfers	
Statutory or formal incidence to whom and what transfer is given	Production	Output returns	Output bounty or deficiency payment	Production tax credit		Government buffer stock	Import tariff or export subsidy Local content requirements & discriminatory government procurement
		Enterprise income	Operating grant	Reduced rate of income tax		Third-party liability limit for producers	Monopoly concession
		Cost of intermediate input	Input-price subsidy	Reduction in excise tax on input	Under-pricing of a government good or service	Provision of security (e.g., military protection of supply lines)	Monopsony concession export restriction
	Costs of production factors	Labour	Wage subsidy	Reduction in social charges (payroll taxes)		Assumption of occupational health and accident liabilities	Wage control
		Land and natural resources	Capital grant linked to acquisition of land	Property tax reduction or exemption	Under-pricing of access to government land or natural resources Reduction in resource to royalty or extraction tax	Capital guarantee linked to acquisition of land	Land-use control
		Capital	Grant tied to the acquisition of assets	Investment tax credit	Debt forgiveness of restructuring	Credit guarantee linked to capital Equity conversion	Credit control (sector-specific)
		Knowledge	Government R&D	Tax credit for private R&D	Government transfer of intellectual property right		Deviations from standard IPR rules
	Direct consumption	Unit cost of consumption	Unit subsidy	VAT or excise tax concession on fuel	Under-pricing of access to a natural resource harvested by final consumer	Price-triggered subsidy	Regulated price Cross subsidy
		Household or enterprise income	Government-subsidized life-line electricity rate	Tax deduction related to energy purchases that exceed given share of income		Means-tested cold-weather grant	Mandated life-line electricity rate

Source: OECD, 2018

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